



## PRODUCT SPECIFICATION

*Part Number*

PT322435E-TLMWD-EXM25

|                      |  |
|----------------------|--|
| CUSTOMER             |  |
| CUSTOMER PART NUMBER |  |
| DESCRIPTION          |  |
| APPROVED BY          |  |
| DATE                 |  |

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### 3. Module Numbering System

PT \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

1. 2. 3. 4. 5. 6. 7. 8. 9 10. 11. 12. 13. 14.

#### 1. P-TEC TFT

#### 2. LENGTH x WIDTH PIXELS

If third character is a zero, it is removed to shorten part number. Example: 240 x 320 = PT3224

#### 3. DIAGONAL DIMENSIONS

Example: 3.5" display = 35 in part number

#### 4. PRODUCT VERSION

Series assigned by P-tec

#### 5. LCD MODE

T: TN

I: IPS

V: VA

#### 6. POLARIZER

LM: Transmissive

LF: Transflective

#### 7. BACKLIGHT COLOR

No Backlight: Left Blank

W: White

B: Blue/Green

S: Yellow/Green

#### 8. VIEWING DIRECTION

D: 6 o'clock

U: 12 o'clock

F: Full Viewing Angle

#### 9. A ~ Z CODE

Assigned by P-tec

#### 11. TEMPERATURE RANGE

Normal: Left Blank

Wide: X

#### 12. LUMINANCE

Blank: Normal (<300 nit)

M: Middle (>= 300 nit)

H: High (> 600 nit)

#### 13. TOUCH PANEL OPTION

No TP: Left Blank

C: Capacitive TP

R: Resistive TP

#### 14. SPECIAL CHARACTERS

Customer special requirements



## 4. Application

This specification is applied to the 3.5 inch QVGA supported TFT-LCD module, and can display 262k colors. The module is designed for PMP, GPS application and other electronic products which require flat panel display of digital signal interface.

## 5. Features

- QVGA (320×240 pixels) resolution.
- Display in 262k colors
- Line inversion mode with stripe type.
- On-chip voltage generator
- SYNC mode is supported for digital RGB input data format.
- This display has extended temperature range.
- Ultra Wide View Polarizer

## 6. General Specifications

| Item                | Specifications                                                                                                                                                                       | Unit |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Screen Size         | 3.5 (Diagonal)                                                                                                                                                                       | inch |
| Display Format      | 320RGB(H)×240(V)                                                                                                                                                                     | dot  |
| Active Area         | 70.08(H)×52.56(V)                                                                                                                                                                    | mm   |
| Dot Pitch           | 0.073(H)×0.219(V)                                                                                                                                                                    | mm   |
| Pixel Configuration | RGB Vertical Stripe                                                                                                                                                                  | -    |
| Display Mode        | TN Type<br>Transmissive Mode<br>Normally White                                                                                                                                       | -    |
| Surface Treatment   | Anti-Glare                                                                                                                                                                           | -    |
| Viewing Direction   | 6 O'clock<br>(The Gray Inversion will appear at this direction)                                                                                                                      | -    |
| Outline Dimension   | 76.9(W)×63.9(H)×3.3(D)                                                                                                                                                               | mm   |
| DC to DC circuit    | Build-in                                                                                                                                                                             | -    |
| Weight              | 32.5                                                                                                                                                                                 | g    |
| RoHS Compliance     | P-tec certifies this product to be in compliance with European Union Directive 2002/95/EC on the restriction of certain hazardous substances in electrical and electronic equipment. | -    |



## 7. Absolute Maximum Ratings

### 7.1 Absolute Ratings of Environment

| Item                  | Symbol          | Value |      | Unit | Note   |
|-----------------------|-----------------|-------|------|------|--------|
|                       |                 | Min.  | Max. |      |        |
| Storage Temperature   | T <sub>ST</sub> | -40   | +80  | °C   | (1)(2) |
| Operating Temperature | T <sub>OP</sub> | -30   | +80  | °C   | (1)(2) |

Note1: Background color changes slightly depending on ambient temperature.

This phenomenon is reversible.

Note2: Please refer to item of RELIABILITY.

### 7.2 Electrical Absolute Ratings

#### 7.2.1 TFT-LCD Module

(Ta=25±2°C, GND=V<sub>SS</sub>=0V)

| Item                         | Symbol          | Value                |      | Unit | Note |
|------------------------------|-----------------|----------------------|------|------|------|
|                              |                 | Min.                 | Max. |      |      |
| Digital Power Supply Voltage | V <sub>CC</sub> | V <sub>SS</sub> -0.3 | 5.0  | V    | -    |

#### 7.2.2 Backlight Unit

(Ta=25±2°C)

| Item            | Symbol         | Value |      | Unit | Note |
|-----------------|----------------|-------|------|------|------|
|                 |                | Min.  | Max. |      |      |
| Forward current | I <sub>f</sub> | -     | (50) | mA   | (1)  |
| Reverse voltage | V <sub>R</sub> | -     | (25) | V    | (1)  |

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.



## 8. Electrical Characteristics

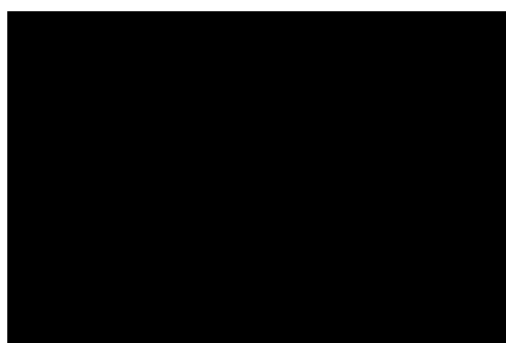
### 8.1 TFT-LCD Module

(Ta=25±2°C)

| Item                         | Symbol          | Value              |       |                    | Unit | Note |
|------------------------------|-----------------|--------------------|-------|--------------------|------|------|
|                              |                 | Min.               | Typ.  | Max.               |      |      |
| Power Supply Voltage         | V <sub>CC</sub> | 2.5                | 3.3   | 3.6                | V    | -    |
| Power Supply Current         | I <sub>CC</sub> | -                  | 15.6  | 22.0               | mA   | (1)  |
| Input High Threshold Voltage | V <sub>IH</sub> | 0.8V <sub>CC</sub> | -     | V <sub>CC</sub>    | V    | -    |
| Input Low Threshold Voltage  | V <sub>IL</sub> | 0                  | -     | 0.2V <sub>CC</sub> | V    | -    |
| Power Consumption            | P <sub>L</sub>  | -                  | 51.48 | 72.6               | mW   | (1)  |
| VSYNC Frequency              | F <sub>V</sub>  | -                  | 60    | 90                 | Hz   | -    |
| HSYNC Frequency              | F <sub>H</sub>  | -                  | 15.72 | 22.35              | KHz  | -    |
| DCLK Frequency               | DCLK            | -                  | 6.5   | 10                 | MHz  | -    |

Note (1) The specified power consumption is under the conditions at V<sub>CC</sub>=3.3V,  
F<sub>V</sub>=60Hz, whereas a power dissipation check pattern below is displayed.

Black Pattern / 0 Gray



Active Area



## 8.2 Backlight Unit

 $(T_a=25\pm 2^{\circ}\text{C})$ 

| Item                | Symbol          | Value |        |      | Unit | Note |
|---------------------|-----------------|-------|--------|------|------|------|
|                     |                 | Min.  | Typ.   | Max. |      |      |
| LED Voltage         | VL              | -     | (16.5) | -    | V    | (1)  |
| LED Current         | IL              | -     | (40)   | -    | mA   | (1)  |
| Power Consumption   | P <sub>BL</sub> | -     | (660)  | -    | mW   | (1)  |
| LED Life Time(25°C) | -               | 10000 | 30000  | -    | hr   | (2)  |

Note (1) The driving design of backlight unit is dependent on serial consideration of 5S2P LEDs.

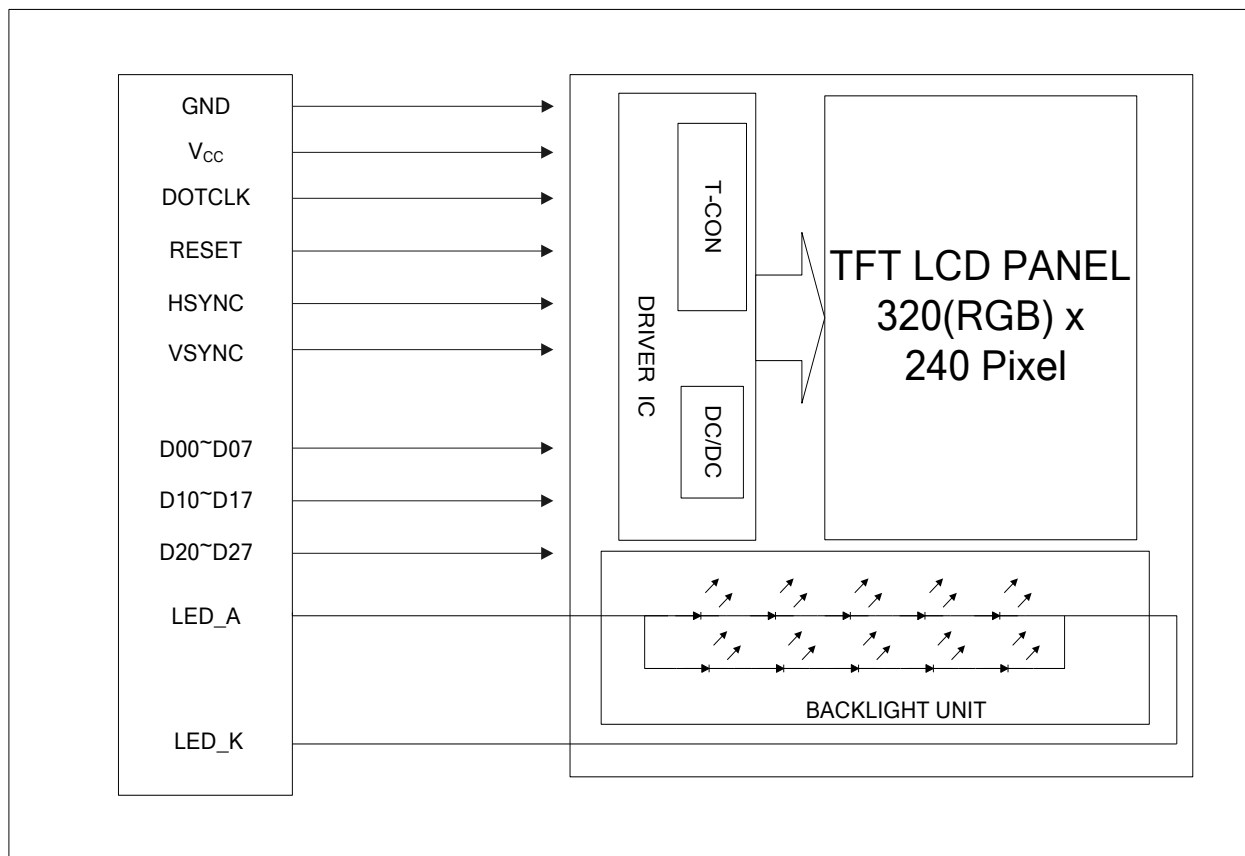
Note (2) LED life time is defined as under  $25\pm 2^{\circ}\text{C}$ , when the average brightness decrease to 50% of original brightness





## 9. Block Diagram

### TFT-LCD Module with Backlight Unit





## 10. Input / Output Terminals Pin Assignment

### 10.1 TFT-LCD Module (CVILUX CF25541D0R0-05)

| Pin No. | Symbol | I/O | Description     |
|---------|--------|-----|-----------------|
| 1       | LED_K  | I   | LED_cathode     |
| 2       | LED_K  | I   | LED_cathode     |
| 3       | LED_A  | I   | LED_anode       |
| 4       | LED_A  | I   | LED_anode       |
| 5       | NC     | I   | No connection   |
| 6       | NC     | I   | No connection   |
| 7       | NC     | I   | No connection   |
| 8       | RESET  | I   | Reset           |
| 9       | NC     | I   | No connection   |
| 10      | NC     | I   | No connection   |
| 11      | NC     | I   | No connection   |
| 12      | D20    | I   | Blue data(LSB)  |
| 13      | D21    | I   | Blue data       |
| 14      | D22    | I   | Blue data       |
| 15      | D23    | I   | Blue data       |
| 16      | D24    | I   | Blue data       |
| 17      | D25    | I   | Blue data       |
| 18      | D26    | I   | Blue data       |
| 19      | D27    | I   | Blue data(MSB)  |
| 20      | D10    | I   | Green data(LSB) |
| 21      | D11    | I   | Green data      |
| 22      | D12    | I   | Green data      |
| 23      | D13    | I   | Green data      |
| 24      | D14    | I   | Green data      |
| 25      | D15    | I   | Green data      |
| 26      | D16    | I   | Green data      |
| 27      | D17    | I   | Green data(MSB) |
| 28      | D00    | I   | Red data(LSB)   |
| 29      | D01    | I   | Red data        |
| 30      | D02    | I   | Red data        |



| Pin No. | Symbol          | I/O | Description                   |
|---------|-----------------|-----|-------------------------------|
| 31      | D03             | I   | Red data                      |
| 32      | D04             | I   | Red data                      |
| 33      | D05             | I   | Red data                      |
| 34      | D06             | I   | Red data                      |
| 35      | D07             | I   | Red data(MSB)                 |
| 36      | HSYNC           | I   | Line synchronization signal.  |
| 37      | VSYNC           | I   | Frame synchronization signal. |
| 38      | DOTCLK          | I   | Dot Clock signal              |
| 39      | NC              | I   | No connection                 |
| 40      | NC              | I   | No connection                 |
| 41      | V <sub>CC</sub> | I   | For system power supply.      |
| 42      | V <sub>CC</sub> | I   | For system power supply.      |
| 43      | NC              | I   | No connection                 |
| 44      | NC              | I   | No connection                 |
| 45      | NC              | I   | No connection                 |
| 46      | NC              | I   | No connection                 |
| 47      | NC              | I   | No connection                 |
| 48      | NC              | I   | No connection                 |
| 49      | NC              | I   | No connection                 |
| 50      | NC              | I   | No connection                 |
| 51      | NC              | I   | No connection                 |
| 52      | NC              | I   | No connection                 |
| 53      | GND             | I   | Ground                        |
| 54      | GND             | I   | Ground                        |



## 10.2 Color Data Input Assignment

The brightness of each primary color(red, green and blue) is based on the 8 bit gray scale data input for the color. The higher the binary input, the brighter the color. The table provides the assignment of color versus data input.

| Color               |                 | Data Signal |     |     |     |     |     |     |     |       |     |     |     |     |     |     |     |      |     |     |     |     |     |     |     |
|---------------------|-----------------|-------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|
|                     |                 | Red         |     |     |     |     |     |     |     | Green |     |     |     |     |     |     |     | Blue |     |     |     |     |     |     |     |
|                     |                 | D07         | D06 | D05 | D04 | D03 | D02 | D01 | D00 | D17   | D16 | D15 | D14 | D13 | D12 | D11 | D10 | D27  | D26 | D25 | D24 | D23 | D22 | D21 | D20 |
| Basic Colors        | Black           | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Red             | 1           | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Green           | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Blue            | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
|                     | Cyan            | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
|                     | Magenta         | 1           | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
|                     | Yellow          | 1           | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1     | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | White           | 1           | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1     | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| Gray Scale Of RED   | Red(0) / Dark   | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Red(1)          | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Red(2)          | 0           | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | :               | :           | :   | :   | :   | :   | :   | :   | :   | :     | :   | :   | :   | :   | :   | :   | :   | :    | :   | :   | :   | :   | :   | :   | :   |
|                     | :               | :           | :   | :   | :   | :   | :   | :   | :   | :     | :   | :   | :   | :   | :   | :   | :   | :    | :   | :   | :   | :   | :   | :   | :   |
|                     | Red(253)        | 1           | 1   | 1   | 1   | 1   | 1   | 0   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Red(254)        | 1           | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Red(255)        | 1           | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Gray Scale Of Green | Green(0) / Dark | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Green(1)        | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Green(2)        | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | :               | :           | :   | :   | :   | :   | :   | :   | :   | :     | :   | :   | :   | :   | :   | :   | :   | :    | :   | :   | :   | :   | :   | :   | :   |
|                     | :               | :           | :   | :   | :   | :   | :   | :   | :   | :     | :   | :   | :   | :   | :   | :   | :   | :    | :   | :   | :   | :   | :   | :   | :   |
|                     | Green(253)      | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 0   | 1   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Green(254)      | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Green(255)      | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1     | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Gray Scale Of Blue  | Blue(0) / Dark  | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|                     | Blue(1)         | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 0   | 1   |
|                     | Blue(2)         | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 0   | 1   | 0   |
|                     | :               | :           | :   | :   | :   | :   | :   | :   | :   | :     | :   | :   | :   | :   | :   | :   | :   | :    | :   | :   | :   | :   | :   | :   | :   |
|                     | :               | :           | :   | :   | :   | :   | :   | :   | :   | :     | :   | :   | :   | :   | :   | :   | :   | :    | :   | :   | :   | :   | :   | :   | :   |
|                     | Blue(253)       | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   | 0   | 1   |
|                     | Blue(254)       | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   | 1   | 0   |
|                     | Blue(255)       | 0           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1    | 1   | 1   | 1   | 1   | 1   | 1   | 1   |



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## 11. Interface Timing

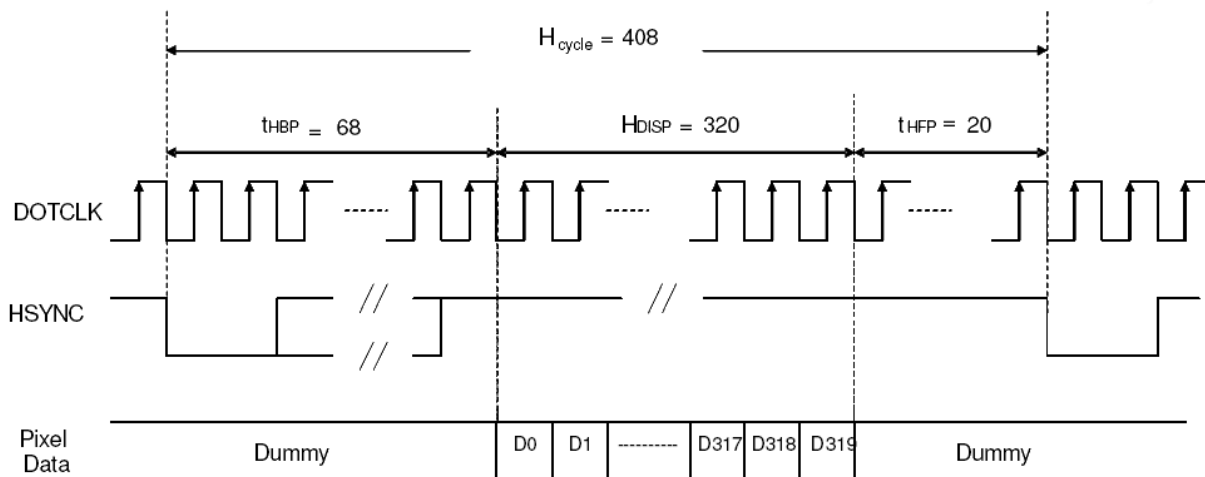
### 11.1 Input Signal Characteristics

#### 11.1.1 Digital Parallel RGB Interface (960×240 resolution)

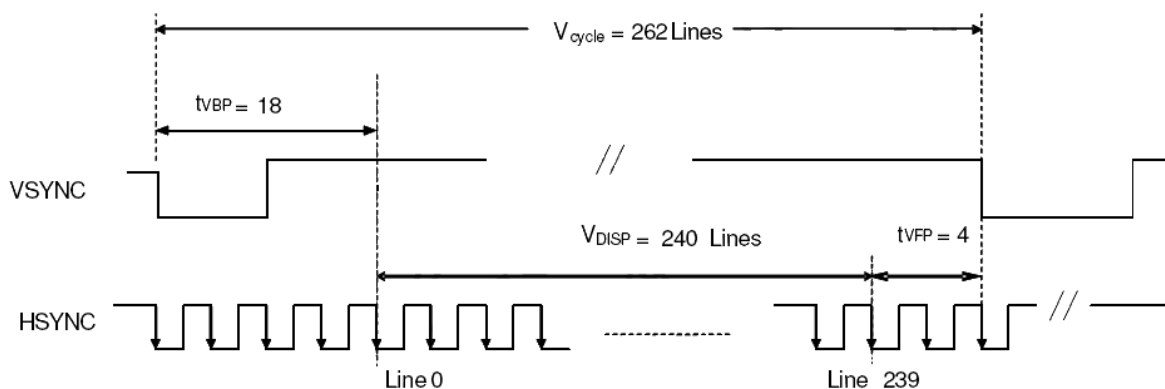
| Characteristics              | Symbol      | Min.   | Typ.        | Max.   | Unit    |
|------------------------------|-------------|--------|-------------|--------|---------|
|                              |             | 24 bit | 24 bit      | 24 bit |         |
| DOTCLK Frequency             | fDOTCLK     | -      | 6.5         | 10     | MHz     |
| DOTCLK Period                | tDOTCLK     | 100    | 154         | -      | ns      |
| Horizontal Frequency (Line)  | fH          | -      | 14.9        | 22.35  | KHz     |
| Vertical Frequency (Refresh) | fV          | -      | 60          | 90     | Hz      |
| Horizontal Back Porch        | tHBP        | -      | 68          | -      | tDOTCLK |
| Horizontal Front Porch       | tHFP        | -      | 20          | -      | tDOTCLK |
| Horizontal Data Start Point  | tHBP        | -      | 68          | -      | tDOTCLK |
| Horizontal Blanking Period   | tHBP + tHFP | -      | 88          | -      | tDOTCLK |
| Horizontal Display Area      | HDISP       | -      | 320         | -      | tDOTCLK |
| Horizontal Cycle             | Hcycle      | -      | 408         | 450    | tDOTCLK |
| Vertical Back Porch          | tVBP        | -      | 18          | -      | Lines   |
| Vertical Front Porch         | tVFP        | -      | 4           | -      | Lines   |
| Vertical Data Start Point    | tVBP        | -      | 18          | -      | Lines   |
| Vertical Blanking Period     | tVBP + tVFP | -      | 22          | -      | Lines   |
| Vertical Display Area        | NTSC        | -      | 240         | -      | Lines   |
|                              | PAL         |        | 280(PALM=0) |        |         |
|                              |             |        | 288(PALM=1) |        |         |
| Vertical Cycle               | NTSC        | -      | 262         | 350    | Lines   |
|                              | PAL         |        | 313         |        |         |



## 11.2 Waveform



Horizontal Data Transaction Timing

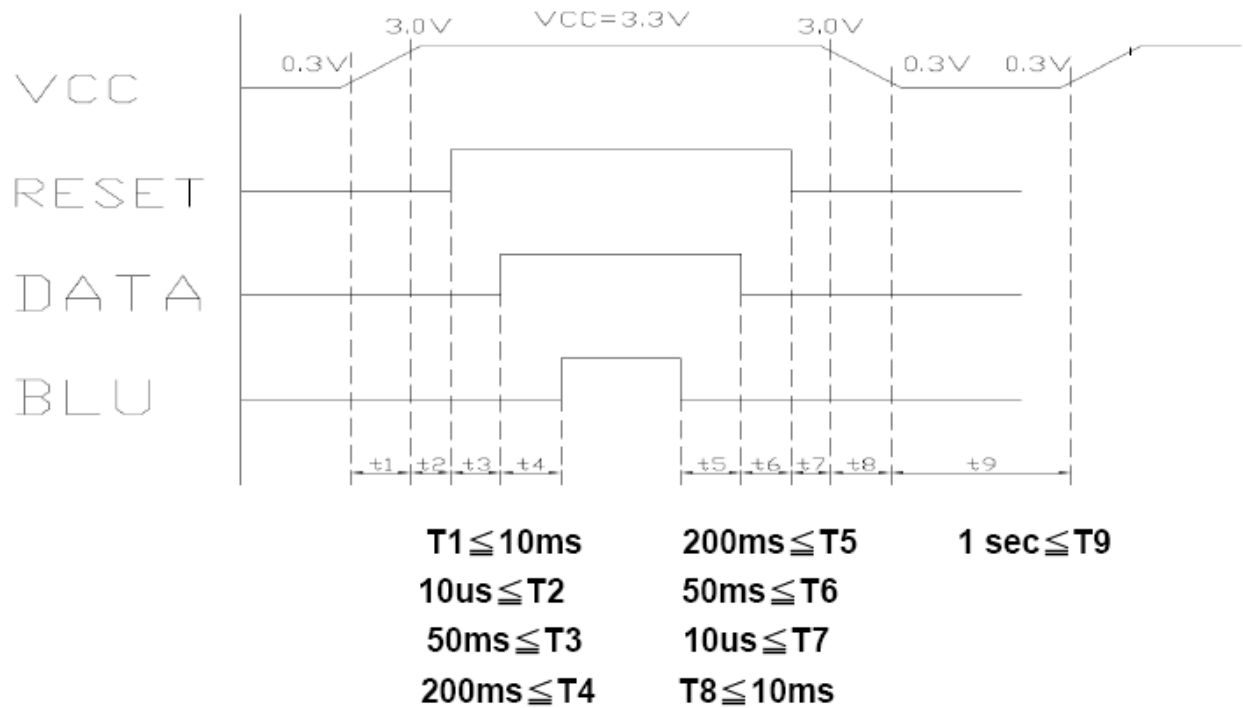


Vertical Data Transaction Timing

Figure 11.2-1 Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)



### 11.3 Power On / Off Sequence





## 12. Optical Characteristics

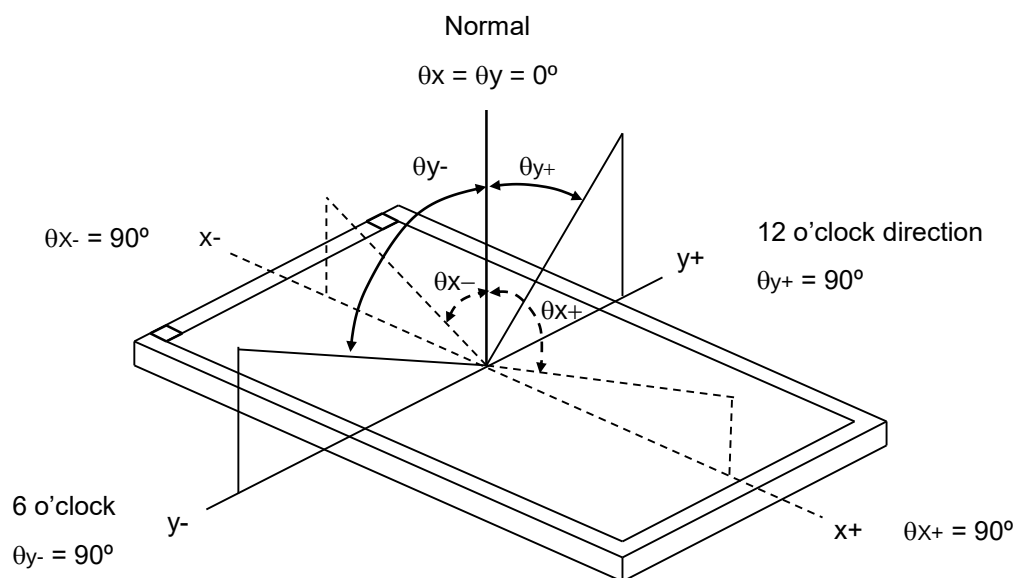
The optical characteristics should be measured in a dark environment ( $\leq 1$  lux) or equivalent state with the methods shown in Note (4).

| Item                  |            | Symbol           | Conditions                                                   | Min.  | Typ.    | Max.  | Unit              | Note    |
|-----------------------|------------|------------------|--------------------------------------------------------------|-------|---------|-------|-------------------|---------|
| Contrast Ratio        |            | CR               | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing Normal Angle | 300   | ( 450 ) | -     | -                 | (2)     |
| Response Time         |            | $T_R+T_F$        |                                                              | -     | 50      | -     | ms                | (3)     |
| Luminance(Center)     |            | Y                |                                                              | 500   | ( 570 ) | -     | cd/m <sup>2</sup> | (4)     |
| Brightness uniformity |            | B <sub>UNI</sub> |                                                              | 75    | ( 80 )  | -     | %                 | (5)     |
| Color Chromaticity    | Red        | R <sub>x</sub>   |                                                              | 0.595 | 0.645   | 0.695 | -                 | (1),(4) |
|                       |            | R <sub>y</sub>   |                                                              | 0.305 | 0.355   | 0.405 | -                 |         |
|                       | Green      | G <sub>x</sub>   |                                                              | 0.305 | 0.355   | 0.405 | -                 |         |
|                       |            | G <sub>y</sub>   |                                                              | 0.545 | 0.595   | 0.645 | -                 |         |
|                       | Blue       | B <sub>x</sub>   |                                                              | 0.090 | 0.140   | 0.190 | -                 |         |
|                       |            | B <sub>y</sub>   |                                                              | 0.045 | 0.095   | 0.145 | -                 |         |
|                       | White      | W <sub>x</sub>   |                                                              | 0.270 | 0.32    | 0.370 | -                 |         |
|                       |            | W <sub>y</sub>   |                                                              | 0.285 | 0.335   | 0.385 | -                 |         |
| Viewing Angle         | Horizontal | $\theta_{x+}$    | CR $\geq$ 10                                                 | 60    | ( 80 )  | -     | deg.              |         |
|                       |            | $\theta_{x-}$    |                                                              | 60    | ( 80 )  | -     |                   |         |
|                       | Vertical   | $\theta_{y+}$    |                                                              | 60    | ( 80 )  | -     |                   |         |
|                       |            | $\theta_{y-}$    |                                                              | 60    | ( 80 )  | -     |                   |         |





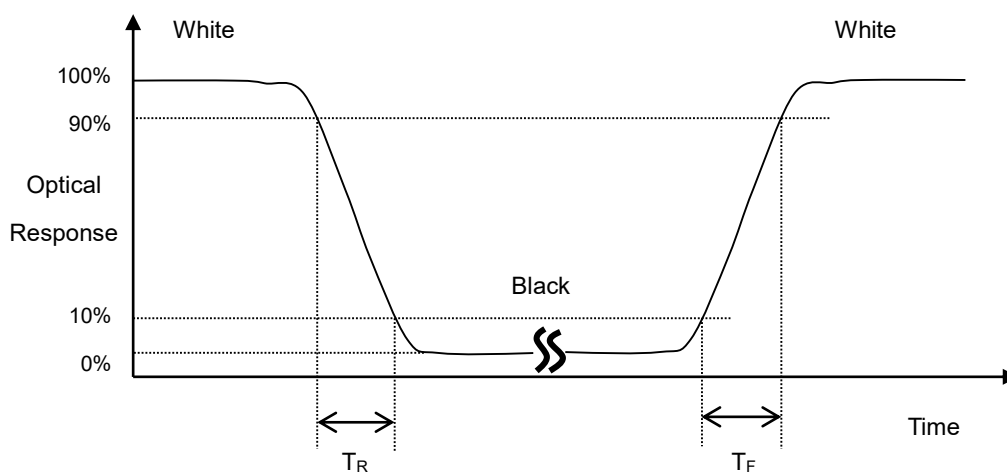
Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

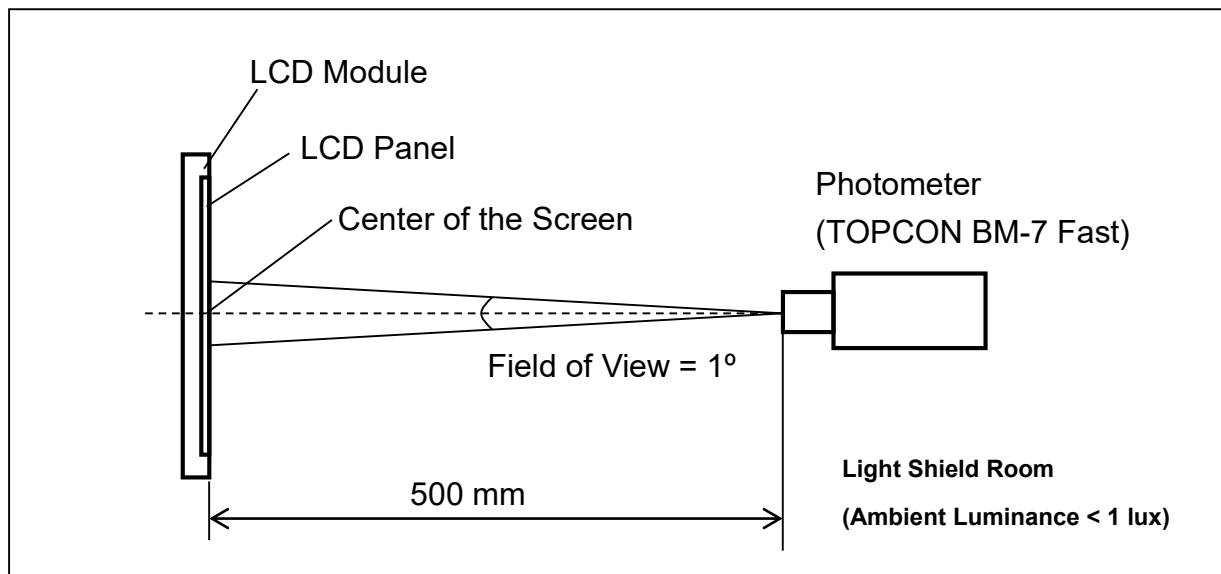
Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):





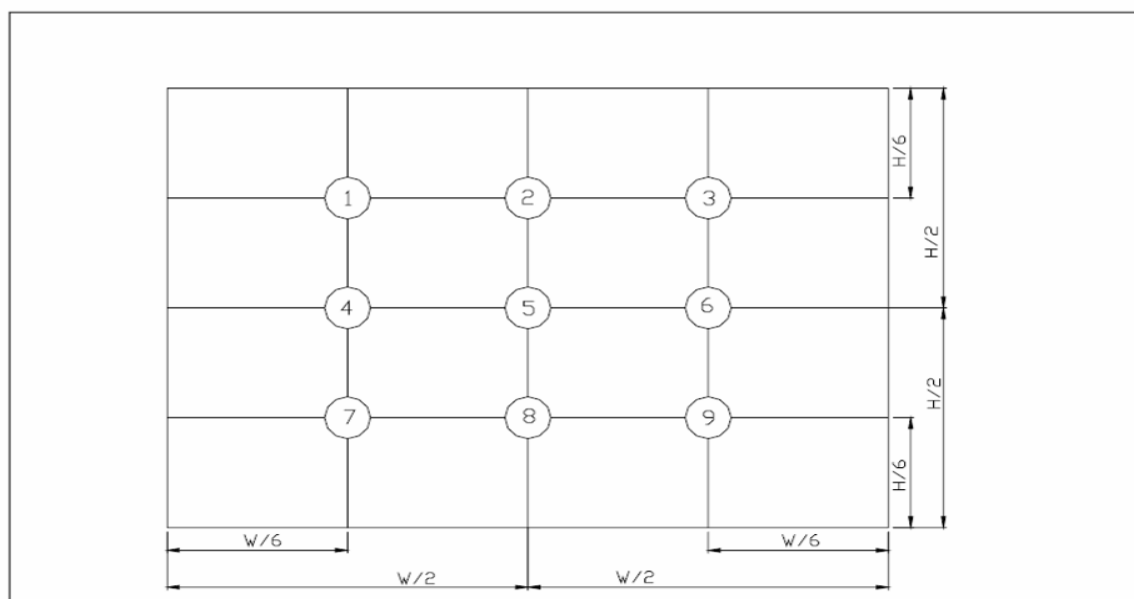
**Note (4) Measurement Set-Up:**

The LCD module should be stabilized at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



**Note (5) Definition of brightness uniformity**

Brightness uniformity=(Min Luminance of 9 points)/(Max Luminance of 9 points)×100%



( 單位 : mm )



### 13. Reliability Test

| No. | Test Items                                        | Test Condition                                                      | Remark      |
|-----|---------------------------------------------------|---------------------------------------------------------------------|-------------|
| 1   | High Temperature Storage Test                     | T <sub>a</sub> = 80°C 240 hours                                     | (1),(3),(4) |
| 2   | Low Temperature Storage Test                      | T <sub>a</sub> = -40°C 240 hours                                    | (1),(3),(4) |
| 3   | High Temperature Operation Test                   | T <sub>s</sub> = 80°C 240 hours                                     | (2),(3),(4) |
| 4   | Low Temperature Operation Test                    | T <sub>a</sub> = -30°C 240 hours                                    | (1),(3),(4) |
| 5   | High Temperature and High Humidity Operation Test | T <sub>a</sub> =60°C 90%RH 240 hours                                | (3),(4)     |
| 6   | Electro Static Discharge Test (non-operating)     | -Panel Surface/Top Case : 150pF, 330Ω<br>Air: ±15kV, Contact: ±8kV  | (3)         |
| 7   | Mechanical Shock Test (non-operating)             | Half sine wave,<br>100G, 6ms<br>3 times shock of each six surfaces  | (3)         |
| 8   | Vibration Test (non-operating)                    | Sine wave:10 ~ 55 ~ 10Hz<br>amplitude:1.5mm<br>3 axis, 2 hours/axis | (3)         |
| 9   | Thermal Shock Test (non-operating)                | -20°C (30min) ~ 70°C (30min),100 cycles                             | (3),(4)     |
| 10  | Drop Test(with Carton)                            | Height: 80cm<br>1 corner, 3 edges, 6 surfaces                       | (3)         |

Note 1: T<sub>a</sub> is the ambient temperature of samples.

Note 2: T<sub>s</sub> is the temperature of panel's surface.

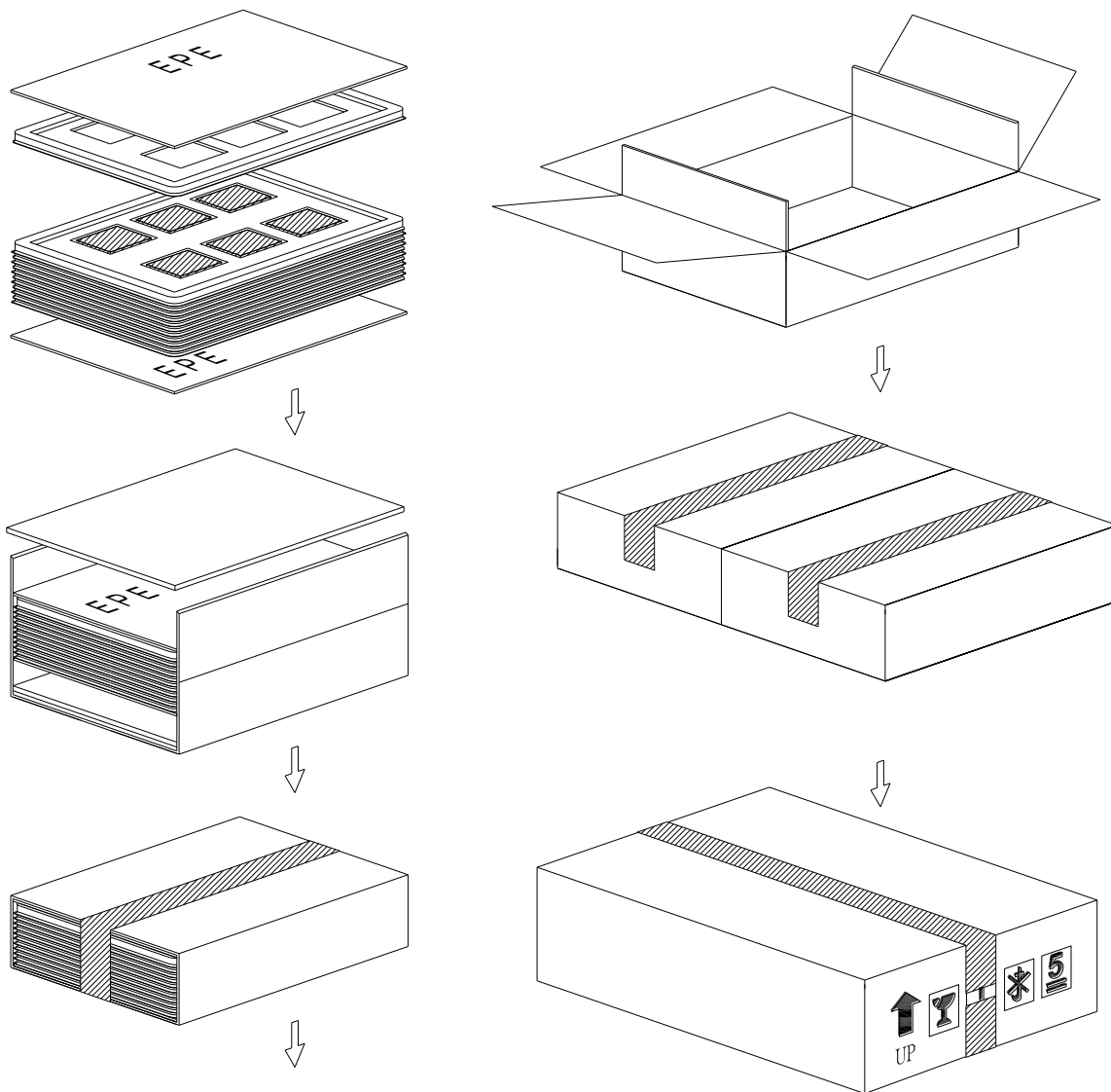
Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

NOTE5: When OP reaches -30 degree, the reaction of the display will be slower. However, this phenomenon is reversible after the ambient temperature returns to higher values.



## 14. Packaging



|   | PARTS LIST        |                     |          |       |      |
|---|-------------------|---------------------|----------|-------|------|
|   | ITEM              | SIZE(LxWxH) unit:mm | MATERIAL | Q.T.Y | NOTE |
| 1 | TRAY              | 372.0x262.0x16.0    |          | 28    |      |
| 2 | EPE(J46)          | 372.0x262.0x5.0     | EPE      | 4     |      |
| 3 | CARD BOARD(P01)   | 816.0x375.0x3.5     | CARTON   | 2     |      |
| 4 | CARD BOARD(P02)   | 945.0x275.0x3.5     | CARTON   | 2     |      |
| 5 | CARD BOARD(P03)   | 375.0x265.0x3.5     | CARTON   | 4     |      |
| 6 | INTERNAL BOX(S01) | 400.0x290.0x150.0   | CARTON   | 2     |      |
| 7 | EXTERNAL BOX(L28) | 600.0x420.0x180.0   |          | 1     |      |
| 8 | PRODUCT           | 76.9x63.9x3.3       |          | 156   |      |



## **15. Precautions**

### **15.1 Assembly and Handling Precautions**

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It's recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) Don't apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD module in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow.

### **15.2 Safety Precautions**

- (1) 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, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

### **15.3 Terms of Warrant**

- (1) Acceptance inspection period

The period is within one month after the arrival of contracted commodity at the buyer's factory site.

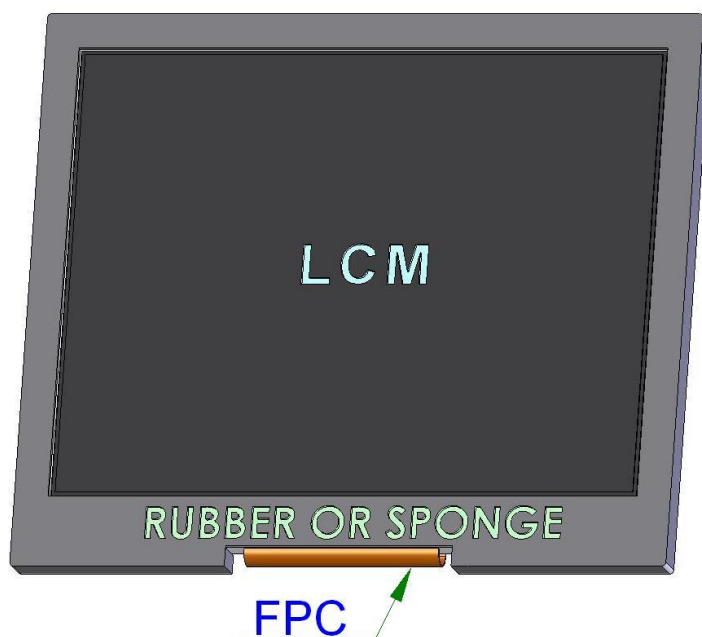
- (2) Applicable warrant period

The period is within twelve months since the date of shipping out under normal using and storage conditions.



### 15.4 Cautions for LCM's installing and assembling

Please keep away the FPC while assembling or fixing the LCM to avoid FPC being damaged or extruded or other related problems. Please see below picture.





**P-TEC**

**MODEL NO.**

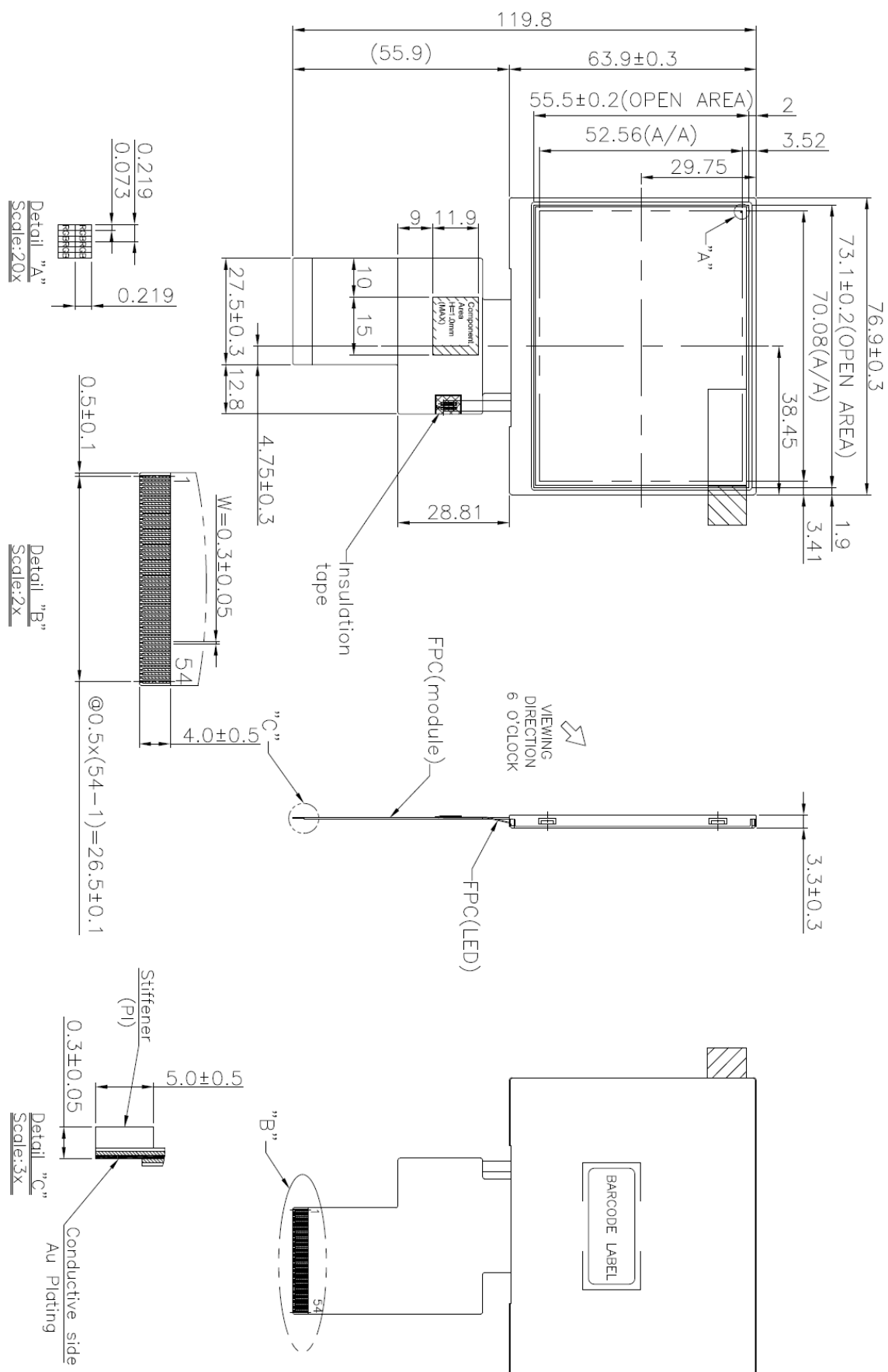
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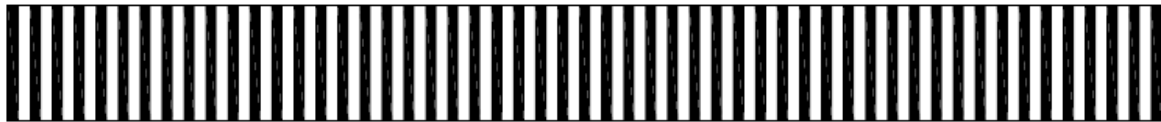
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## 16.Outline Drawing

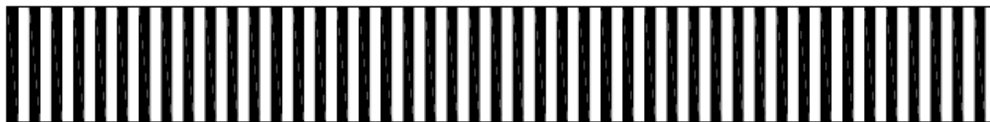


**17. Definition of Labels**

The bar code nameplate is pasted on each module as illustration, and its definitions are as following explanation.



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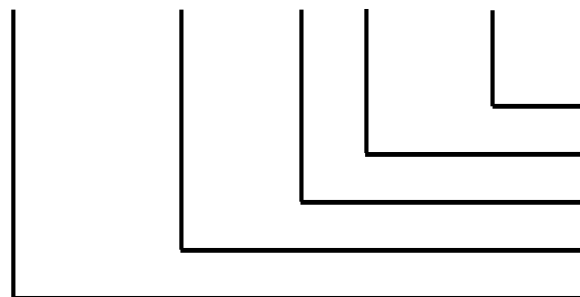


ABCDEFGHIJKLM

(a) Module Name: PT322435E-TLMWD-EM25

(b) Serial ID:

A B C D E F G H I J K L M



Serial No.  
Revision Code  
Factory Code  
Manufactured Date  
Screen Size

Serial ID includes the information as below:

(a) Screen size (Diagonal): Inch Code (ABCD)

3.5" → 0350

10.4" → 1040

(b) Manufactured Date: Year, Month, Day (EFG)

Year (E)

|      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|
| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Mark | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| Mark | A    | B    | C    | D    | E    | F    | G    | H    | I    | J    |



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Month (F)

| Month | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|-------|------|------|------|------|-----|------|------|------|------|------|------|------|
| Mark  | 1    | 2    | 3    | 4    | 5   | 6    | 7    | 8    | 9    | A    | B    | C    |

Day (G)

| Day  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Mark | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | A  | B  | C  | D  | E  | F  | G  |
| Day  | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |
| Mark | H  | I  | J  | K  | L  | M  | N  | O  | P  | Q  | R  | S  | T  | U  | V  |    |

(c) Factory Code (H):

For P-TEC internal use.

(d) Revision Code (I):

Cover all the change, for example: 1: Rev.1, 2: Rev.2, 3: Rev.3...etc.

(e) Serial No. (JKLM):

Manufacturing sequence of product, for example: 0001~9999.



## 18. Incoming Inspection Standards

### 18.1 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature  $25 \pm 5^{\circ}\text{C}$
- (2) Humidity:  $60 \pm 5\%$  RH
- (3) Viewing distance is approximately 35 ~ 40 cm
- (4) Viewing angle is normal to the LCD panel as Fig \_1( $10^{\circ}$ )
- (5) Ambient Illumination: 300 ~ 500 Lux for external appearance inspection

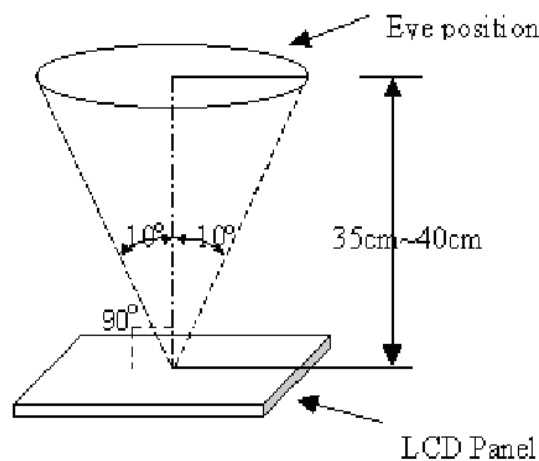


Fig \_ 1

### 18.2 The defects classify of AQL as following:

- (1) Test method :According to [ANSI/ASQC Z 1.4](#) .General Inspection Level II take a single time
- (2) The defects classify of AQL as following:

| Class of defects | AQL   | Definition                                                                                                       |
|------------------|-------|------------------------------------------------------------------------------------------------------------------|
| Major            | 0.65% | It is defect that is likely to result in failure or to reduce materially the usability of the intended function. |
| Minor            | 1.5%  | It is a defect that will not result in functioning problem with deviation classified.                            |



### 18.3 Inspection Parameters

| Item                                      |                                                      | Specification/Description                                                    |                   |                              |            | Note                   |
|-------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------|-------------------|------------------------------|------------|------------------------|
| Display                                   | Function                                             | No Display                                                                   |                   |                              |            | -                      |
|                                           |                                                      | Malfunction                                                                  |                   |                              |            | -                      |
| Operating                                 | Contrast ratio                                       | Out of Spec                                                                  |                   |                              |            | -                      |
|                                           | Line defect                                          | No obvious Vertical and Horizontal line defect in bright , dark and colored. |                   |                              |            | -                      |
| Operating                                 | Point Defect<br>(red,green,blue,<br>dark , white)    | Item                                                                         | Acceptable number |                              |            | Note: 1 、<br>4 、 5 、 6 |
|                                           |                                                      |                                                                              | A                 | B                            | Total      |                        |
|                                           |                                                      | BRIGHT DOT                                                                   | $N \leq 0$        | $N \leq 2$                   | $N \leq 6$ |                        |
|                                           |                                                      | DARK DOT                                                                     | $N \leq 2$        | $N \leq 4$                   |            |                        |
|                                           |                                                      | TOTAL DOT                                                                    | $N \leq 2$        | $N \leq 4$                   |            |                        |
|                                           |                                                      | TWO ADJACENT DOT                                                             | NOT ALLOWED       |                              |            |                        |
|                                           |                                                      | THREE OR MORE<br>ADJACENT DOT                                                | NOT ALLOWED       |                              |            |                        |
| External<br>Inspection<br>(non-operating) | Scratch on the<br>polarizer                          | L(mm)                                                                        | W(mm)             | Acceptable number            |            | Note:2                 |
|                                           |                                                      | $L \leq 2.5$                                                                 | $W \leq 0.1$      | 3                            |            |                        |
|                                           |                                                      | $L > 2.5$                                                                    | $W > 0.1$         | 0                            |            |                        |
|                                           | Dent or bubble<br>on the polarizer                   | Dimension(mm)                                                                |                   | Acceptable number            |            | Note:3                 |
|                                           |                                                      | $D \leq 0.3$                                                                 |                   | 3                            |            |                        |
|                                           |                                                      | $D \leq 0.15$                                                                |                   | Disregard                    |            |                        |
|                                           | Line Criteria or<br>Dot Criteria on<br>the polarizer | Inactive dot                                                                 |                   | Acceptable number            |            | Note:2 、 3             |
|                                           |                                                      | $D \leq 0.2$                                                                 |                   | Disregard                    |            |                        |
|                                           |                                                      | $0.2 \leq D \leq 0.3\text{mm}$<br>$L \leq 1.8\text{mm}, W \leq 0.1\text{mm}$ |                   | Line & dot number $N \leq 6$ |            |                        |
|                                           | Missing figure<br>on the polarizer                   | Inactive dot                                                                 |                   | Acceptable number            |            | Note:2 、 3             |
|                                           |                                                      | $D < 0.2\text{mm}$                                                           |                   | Disregard                    |            |                        |
|                                           |                                                      | $0.2 \leq D \leq 0.3\text{mm}$<br>$L \leq 1\text{mm}, W \leq 0.1\text{mm}$   |                   | Line & dot number $N \leq 4$ |            |                        |

Note: 1 、  
4 、 5 、 6

Note:2

Note:3

Note:2 、 3

Note:2 、 3



**P-TEC**

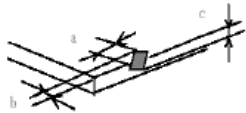
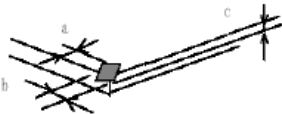
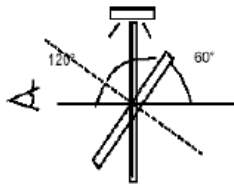
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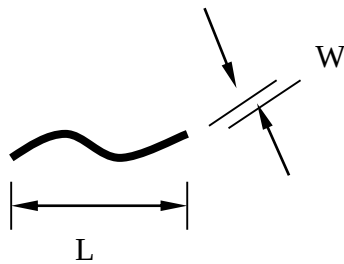
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| Item        |                                       | Specification/Description                                                                                                                                                                                                     |                     |                                                                                | Note   |
|-------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------|--------|
| Touch Panel | Scratch                               | L(mm)                                                                                                                                                                                                                         | W(mm)               | Acceptable number                                                              | Note:2 |
|             |                                       | $L \leq 10$                                                                                                                                                                                                                   | $W < 0.05$          | Disregard                                                                      |        |
|             |                                       |                                                                                                                                                                                                                               | $0.05 \leq W < 0.1$ | $N \leq 4$                                                                     |        |
|             |                                       |                                                                                                                                                                                                                               | $W \geq 0.1$        | 0                                                                              |        |
|             | Foreign Materials<br>(Linear shape)   | $L \leq 10$                                                                                                                                                                                                                   | $W < 0.05$          | Disregard                                                                      | Note:2 |
|             |                                       |                                                                                                                                                                                                                               | $0.05 \leq W < 0.1$ | $N \leq 3$                                                                     |        |
|             |                                       |                                                                                                                                                                                                                               | $W \geq 0.1$        | 0                                                                              |        |
|             | Foreign Materials<br>(Circular shape) | Dimension(mm)                                                                                                                                                                                                                 |                     | Acceptable number                                                              | Note:3 |
|             |                                       | $D \leq 0.25$                                                                                                                                                                                                                 |                     | Disregard                                                                      |        |
|             |                                       | $0.25 < D \leq 0.5$                                                                                                                                                                                                           |                     | $N \leq 6$                                                                     |        |
|             |                                       | $D > 0.5$                                                                                                                                                                                                                     |                     | 0                                                                              |        |
|             | Glass chipping                        |                                                                                                                                             |                     | $a \leq 5.0\text{mm}$<br>$b \leq 3.0\text{mm}$<br>$c \leq t$ (t : Glass think) | Note:7 |
|             |                                       |                                                                                                                                            |                     | $a \leq 3.0\text{mm}$<br>$b \leq 3.0\text{mm}$<br>$c \leq t$ (t : Glass think) | Note:7 |
|             | Newton-ring                           | (In case of doubtful situations)<br>Observe on $60^\circ$ from the product surface under a while Fluorescent lamp (3-wavelength lamp).<br> |                     | Average diameter $\leq 1/3$ Touch Panel area Disregard.                        | Note:7 |
|             | Membrane Drum                         |                                                                                                                                            |                     | $H \leq 0.3\text{mm}$                                                          |        |

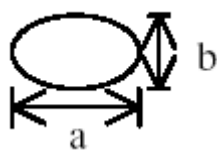


Note1. The definition of dot defect : The dot defect was judged after repair and the size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

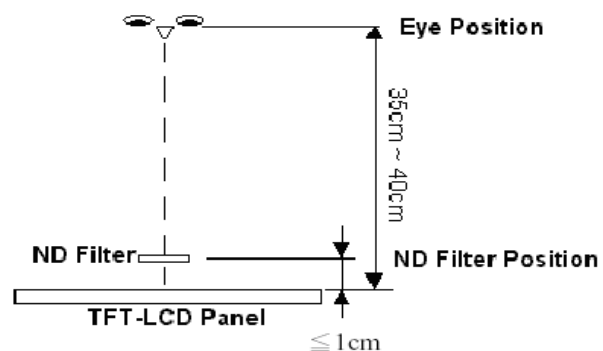
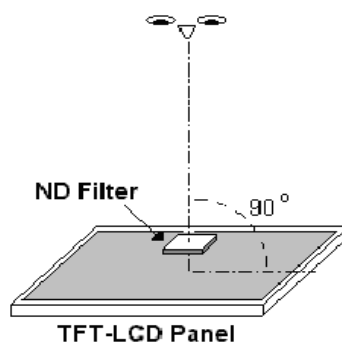
Note2.



Note3. D : Diameter  $D=(a+b)/2$



Note4. Bright dot is defined through 6% transmission ND Filter as following.

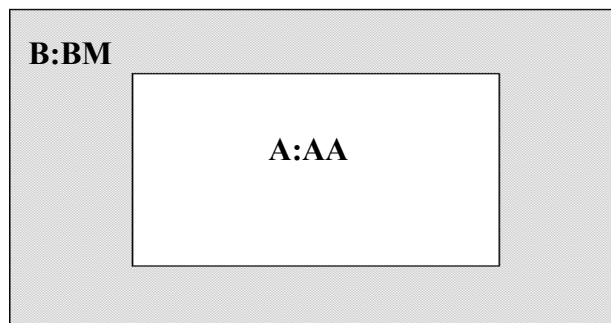


Note5. ADJACENT DOT

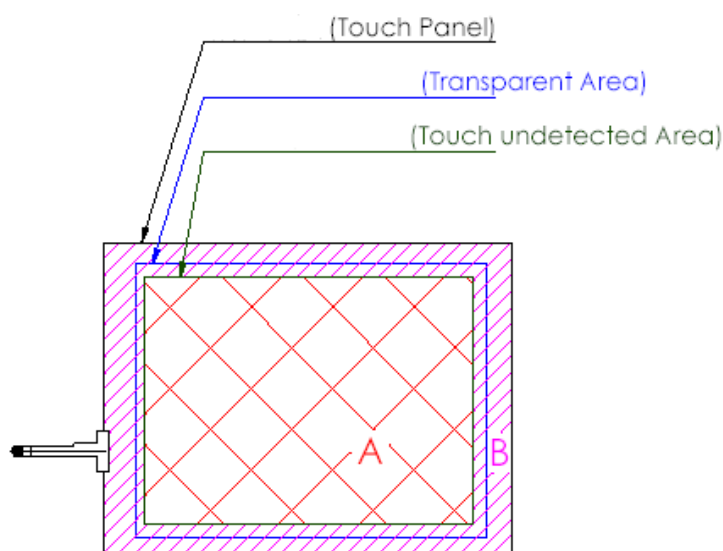




Note6.



Note7.



A area : Without any defect point effect on normal operation.

B area : None-specify

## 18.4 Handling of LCM

- (1) Don't give external shock.
- (2) Don't apply excessive force on the surface.
- (3) Liquid in LCD is hazardous substance. Must not lick and swallow. when the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't disassemble the LCM.