

# TFT LCD MODULE SPEC>

Item No: FG010800ANSWA-1

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**2. RECORD OF REVISION**

| Rev | Date | Item | Page | Comment |
|-----|------|------|------|---------|
|     |      |      |      |         |

### 3. General specifications

| Parameter            | Specifications              | Unit |
|----------------------|-----------------------------|------|
| Display resolution   | 280(W) x 220(H)             | dot  |
| Active area          | 35.6(W) x 26.6(H)           | mm   |
| Screen size          | 1.75(Diagonal)              | inch |
| Dot size             | 0.102(W) x 0.090(H)         | mm   |
| Dot pitch            | 0.127(W) x 0.121(H)         | mm   |
| Color configuration  | R.G.B. delta                |      |
| Overall dimension    | 48.6(W) x 39.6(H) x 6.1(D)  | mm   |
| Weight               | 22±5                        | g    |
| Surface treatment    | Anti-glare(Haze=6% typical) |      |
| View Angle direction | 6 o'clock                   |      |

### 4. Absolute maximum ratings

| Item                  | Svmbol            | Condition   | Min. | Max.         | Unit | Remark              |
|-----------------------|-------------------|-------------|------|--------------|------|---------------------|
| Power Voltage         | $V_{CC}$          | GND=0       | -0.3 | 7            | V    |                     |
|                       | $AV_{DD}$         | $AV_{SS}=0$ | -0.3 | 7            | V    |                     |
|                       | $V_{GH}$          | GND=0       | -0.3 | 21           | V    |                     |
|                       | $V_{GL}$          |             | -15  | 0.3          | V    |                     |
|                       | $V_{GH} - V_{GL}$ |             | -    | 31           | V    |                     |
| Input signal voltage  | $V_I$             |             | -0.2 | $V_{CC}+0.3$ | V    | Note 1              |
|                       | $V_I$             |             | -0.3 | $V_{CC}+0.3$ | V    | Note 2              |
|                       | VCOM              |             | -2.9 | 5.2          | V    |                     |
| Operating temperature | Topa              |             | 0    | 60           | °C   | Ambient temperature |
| Storage temperature   | Tstg              |             | -25  | 80           | °C   | Ambient temperature |
| Backlight voltage     | $V_L$             |             | -0.3 | 6.0          | V    |                     |

Note 1: VR, VG, VB.

Note 2: STHL, STHR, Q1H, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.

## 5. Electrical characteristics

### a. Typical operating conditions (GND=AV<sub>SS</sub>=0V)

| Item                                | Symbol          | Min      | Typ                | Max.     | Unit               | Remark                      |
|-------------------------------------|-----------------|----------|--------------------|----------|--------------------|-----------------------------|
| Power supply                        | V <sub>CC</sub> | 4.8      | 5                  | 5.2      | V                  |                             |
|                                     | AVDD            | 4.8      | 5                  | 5.2      | V                  |                             |
|                                     | VGH             | 14.3     | 15                 | 15.7     | V                  |                             |
|                                     | VGLAC           | -        | 6.0                | -        | Vp-p               | AC component of VGL. Note 1 |
|                                     | VGL-H           | -10.5    | -10                | -9.5     | V                  | High level of VGL.          |
| Video signal Amplitude (VR, VG, VB) | VIA             | AVSS+0.4 | -                  | AVDD-0.4 | V                  | Note 2                      |
|                                     | VIAC            | -        | 3                  | 3.8      | V                  | AC component                |
|                                     | VIDC            | -        | AVDD/2             | -        | V                  | DC component                |
| VCOM                                | VCAC            | -        | 6                  | -        | Vp-p               | AC component, Note 3        |
|                                     | VCDC            | 1.5      | 1.6                | 1.7      | V                  | DC component                |
| Input Signal voltage                | H Level         | VIH      | 0.8V <sub>CC</sub> | -        | V <sub>CC</sub>    | Note 4                      |
|                                     | L Level         | VIL      | 0                  | -        | 0.2V <sub>CC</sub> |                             |

Note 1: The same phase and amplitude with common electrode driving signal(VCOM).

Note 2: Refer to Fig.3(Page:10/26)

Note 3: The brightness of LCD panel could be changed adjusting the AC component of VCOM.

Note 4: STHL, STHR, Q1H, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.

Note 5: Be sure to apply GND, VCC and VGL (VGL must lower than 0 volt ) to the LCD first, and then apply VGH.

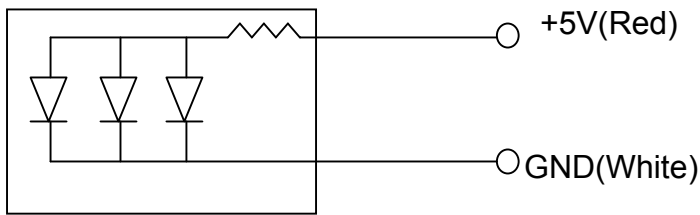
### b. Current consumption (GND=AV<sub>SS</sub>=0V)

| Parameter          | Symbol          | Condition             | Min. | Typ. | Max. | Unit | Remark |
|--------------------|-----------------|-----------------------|------|------|------|------|--------|
| Current for driver | I <sub>GH</sub> | V <sub>GH</sub> =15V  | -    | 1.6  | 4    | mA   |        |
|                    | I <sub>GL</sub> | V <sub>GL</sub> =-10V | -    | -1.6 | -4   | mA   |        |
|                    | I <sub>CC</sub> | V <sub>CC</sub> =5V   | -    | 0.8  | 2    | mA   |        |
|                    | I <sub>DD</sub> | AV <sub>DD</sub> =5V  | -    | 2.5  | 8    | mA   |        |

### c. Backlight driving conditions(LED)

| Parameter     | Symbol         | Min.  | Typ.  | Max. | Unit | Remark                |
|---------------|----------------|-------|-------|------|------|-----------------------|
| LED voltage   | V <sub>L</sub> | --    | 5.0   | --   | V    | I <sub>L</sub> =60 mA |
| LED current   | I <sub>L</sub> | 50    | 60    | 70   | mA   |                       |
| LED life Time |                | 50000 | 80000 | --   | hr   | Note1                 |

Note 1: Ta=25°C, V<sub>L</sub>=3.5V



## 6 ELECTRO-OPTICAL CHARACTERISTIC

| Item               |        | Symbol | Condition                  | Min. | Typ. | Max. | Unit | Remark   |
|--------------------|--------|--------|----------------------------|------|------|------|------|----------|
| Response time      | Rise   | Tr     | $\theta=0^\circ$           | -    | 25   | 50   | ms   | Note 4   |
|                    | Fall   | Tf     |                            | -    | 30   | 60   | ms   |          |
| Contrast ratio     |        | CR     | At optimized viewing angle | 60   | 150  |      |      | Note 5,6 |
| Viewing angle      | Top    |        | $CR \geq 10$               | 10   | -    | -    | Deg. | Note 7   |
|                    | Bottom |        |                            | 30   | -    | -    |      |          |
|                    | Left   |        |                            | 45   | -    | -    |      |          |
|                    | Right  |        |                            | 45   | -    | -    |      |          |
| Brightness         |        | YL     | $\theta=0^\circ$           | 120  | 150  | -    | nit  | Note 8   |
| White chromaticity | X      |        | $\theta=0^\circ$           | 0.28 | 0.31 | 0.34 |      |          |
|                    | y      |        |                            | 0.28 | 0.32 | 0.34 |      |          |
| Color temperature  |        | $K_L$  | $\theta=0^\circ$           |      | 7000 |      | k    |          |

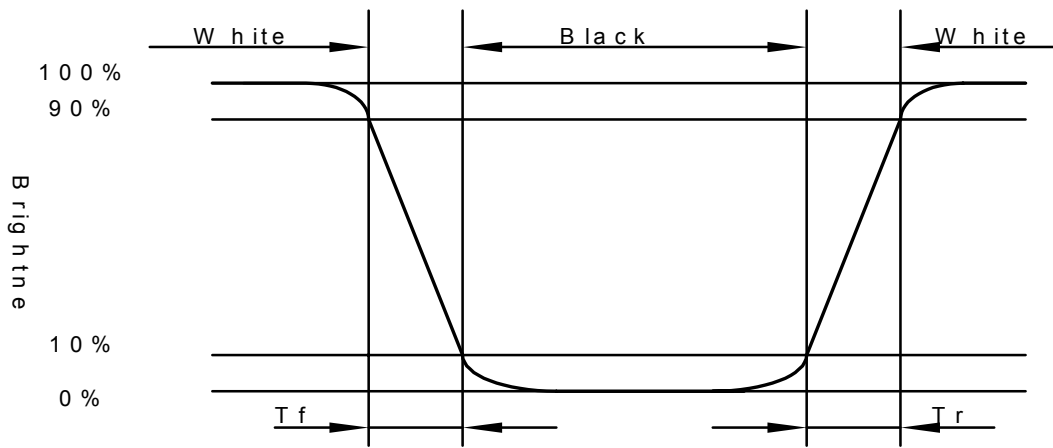
Note 1: Ambient temperature =25°C. and LED current  $I_L=60mA$ .

Note 2: To be measured in the dark room.

Note 3: To be measured on the center area of panel with a viewing cone of  $1^\circ$  by Topcon luminance meter BM-7, after 10 minutes operation.

Note 4: Definition of response time:

The output signals of photo-detector are measured when the input signals are changed from "black" to "white"(rising time) and from "white" to "black"(falling time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as shown in next page.



Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo-detector output when LCD is at "White" state}}{\text{Photo-detector output when LCD is at "Black" state}}$$

Note 6. White  $V_i = V_{i50} \mp 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

" $\pm$ " means that the analog input signal swings in phase with  $V_{COM}$  signal.

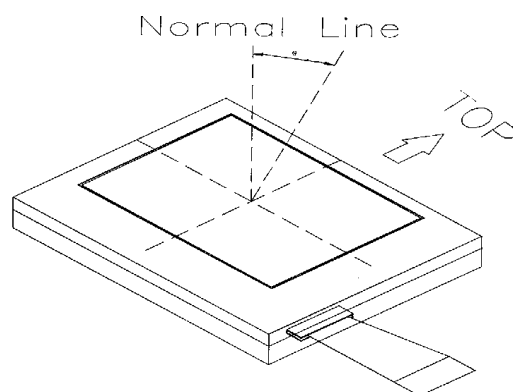
" $\mp$ " means that the analog input signal swings out of phase with  $V_{COM}$  signal.

" $V_{i50}$ ": The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 7. Definition of viewing angle:

Refer to figure as below



Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

## 7. TIMING CHARALTERISTICS

### a. Timing conditions (AC Timing)

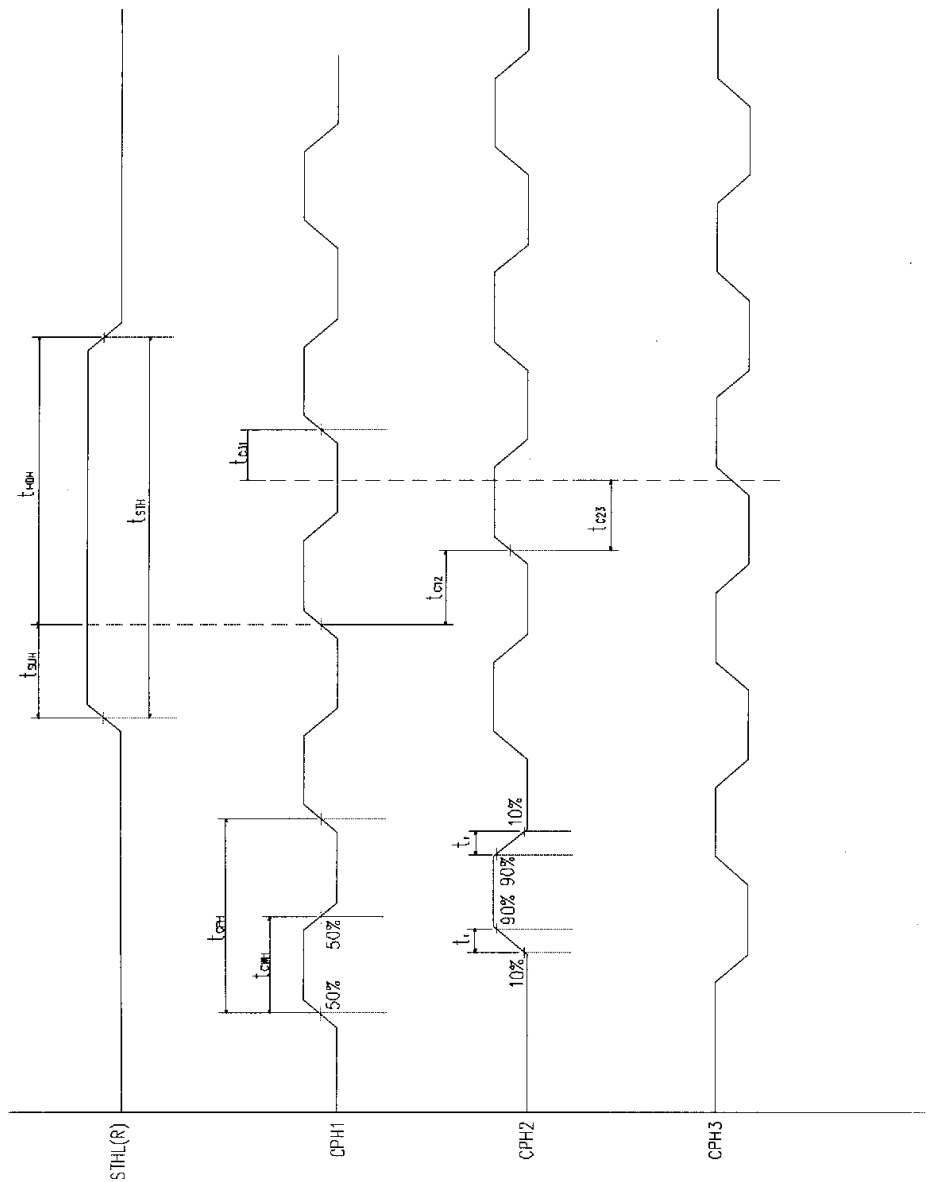
| Parameter                       | Symbol                          | Min. | Typ.        | Max.        | Unit.       | Remark    |
|---------------------------------|---------------------------------|------|-------------|-------------|-------------|-----------|
| Rising time                     | $t_r$                           | -    | -           | 10          | ns          | Note 1    |
| Falling time                    | $t_f$                           | -    | -           | 10          | ns          | Note 1    |
| High and low level pulse width  | $t_{CPH}$                       | 450  | 500         | 550         | ns          | CPH1~CPH3 |
| CPH pulse duty                  | $t_{CWH}$                       | 40   | 50          | 60          | %           | CPH1~CPH3 |
| CPH pulse delay                 | $t_{C12}, t_{C23}$<br>$t_{C31}$ | 70   | $t_{CPH}/3$ | $t_{CPH}/2$ | ns          | CPH1~CPH3 |
| STH setup time                  | $t_{SUH}$                       | 70   | -           | -           | ns          | STHR,STHL |
| STH hold time                   | $t_{HDH}$                       | 400  | -           | -           | ns          | STHR,STHL |
| STH pulse width                 | $t_{STH}$                       | -    | 1           | -           | $t_{CPH}$   | STHR,STHL |
| STH period                      | $t_H$                           | 61.5 | 63.5        | 65.5        | $\mu s$     | STHR,STHL |
| OEH pulse width                 | $t_{OEH}$                       | -    | 3           | -           | $t_{CPH}$   | OEH       |
| Sample and hold disable time    | $t_{DIS1}$                      | -    | 20          | -           | $t_{CPH}$   |           |
| OEV pulse width                 | $t_{OEV}$                       | -    | 5           | -           | $t_{CPH}$   | OEV       |
| CKV pulse width                 | $t_{CKV}$                       | 2    | 6           | 10          | $t_{CPH}$   | CKV       |
| Clean enable time               | $t_{DIS2}$                      | -    | 4           | -           | $t_{CPH}$   |           |
| Horizontal display start        | $t_{SH}$                        | -    | 4           | -           | $t_{CPH}/3$ |           |
| Horizontal display timing range | $t_{DH}$                        | -    | 280         | -           | $t_{CPH}/3$ |           |
| STV setup time                  | $t_{SUV}$                       | 400  | -           | -           | ns          | STVL,STVR |
| STV hold time                   | $t_{HDV}$                       | 400  | -           | -           | ns          | STVL,STVR |
| STV pulse width                 | $t_{STV}$                       | -    | -           | 1           | $t_H$       | STVL,STVR |
| Horizontal lines per field      | $t_V$                           | 256  | 262         | 268         | $t_H$       |           |
| Vertical display start          | $t_{SV}$                        | -    | 10          | -           | $t_H$       |           |
| Vertical display timing range   | $t_{DV}$                        | -    | 220         | -           | $t_H$       |           |
| VCOM rising time                | $t_{rCOM}$                      | -    | -           | 3           | $\mu s$     |           |
| VCOM falling time               | $t_{fCOM}$                      | -    | -           | 3           | $\mu s$     |           |
| VCOM delay time                 | $t_{DCOM}$                      | -    | -           | 3           | $\mu s$     |           |
| RGB delay time                  | $t_{DRGB}$                      | -    | -           | 2           | $\mu s$     |           |

Note 1: For all of the logic signals.

b. Timing diagram

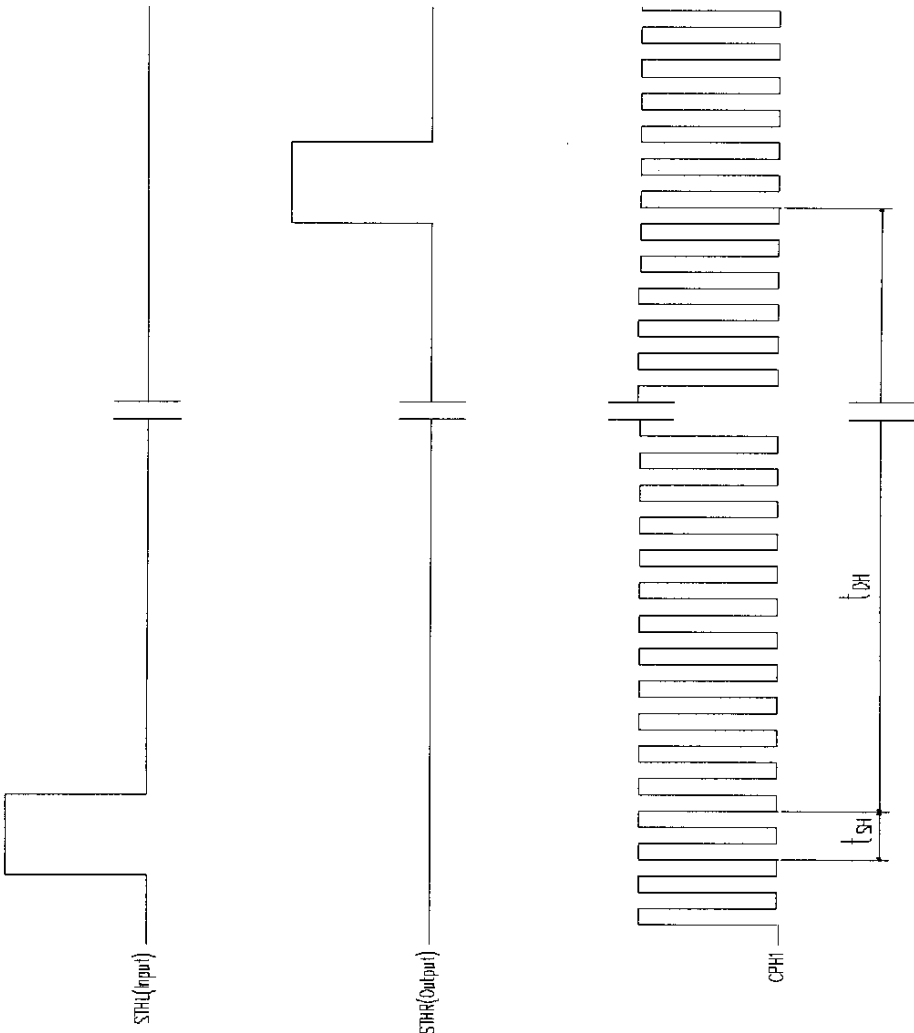
Please refer to the attached drawings, from Fig1 to Fig5.

FIG 1:



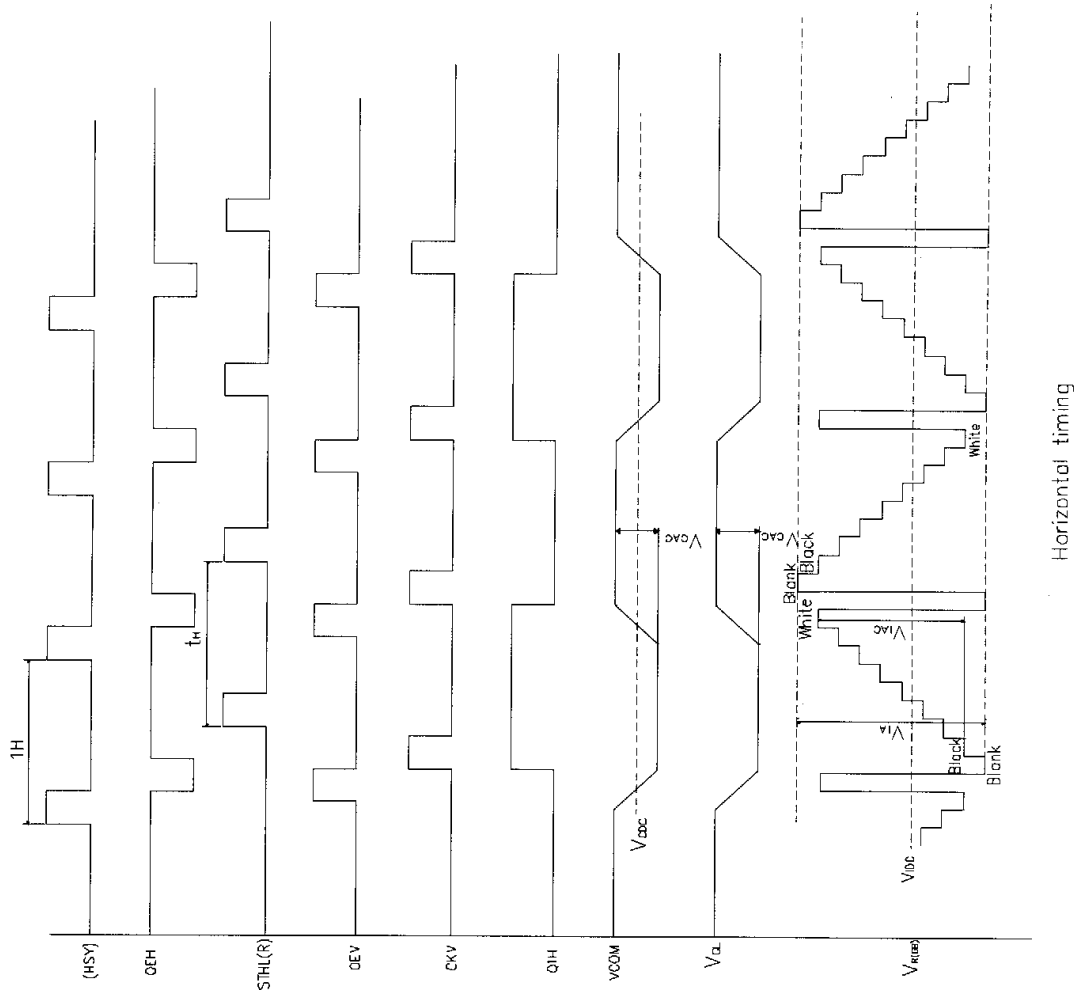
Sampling clock timing

FIG2 :



Horizontal display timing range(Normal scanning mode)

FIG 3:

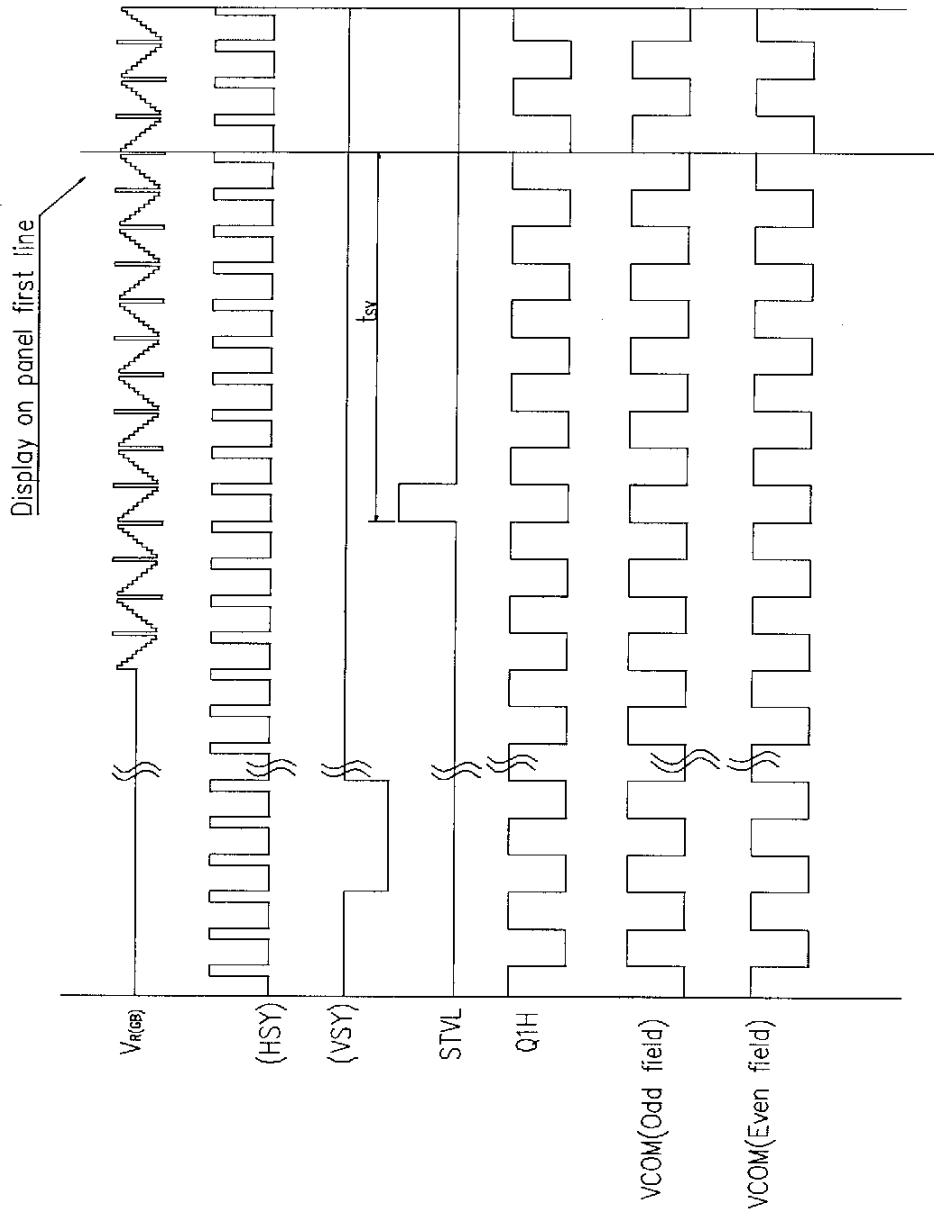


Horizontal timing



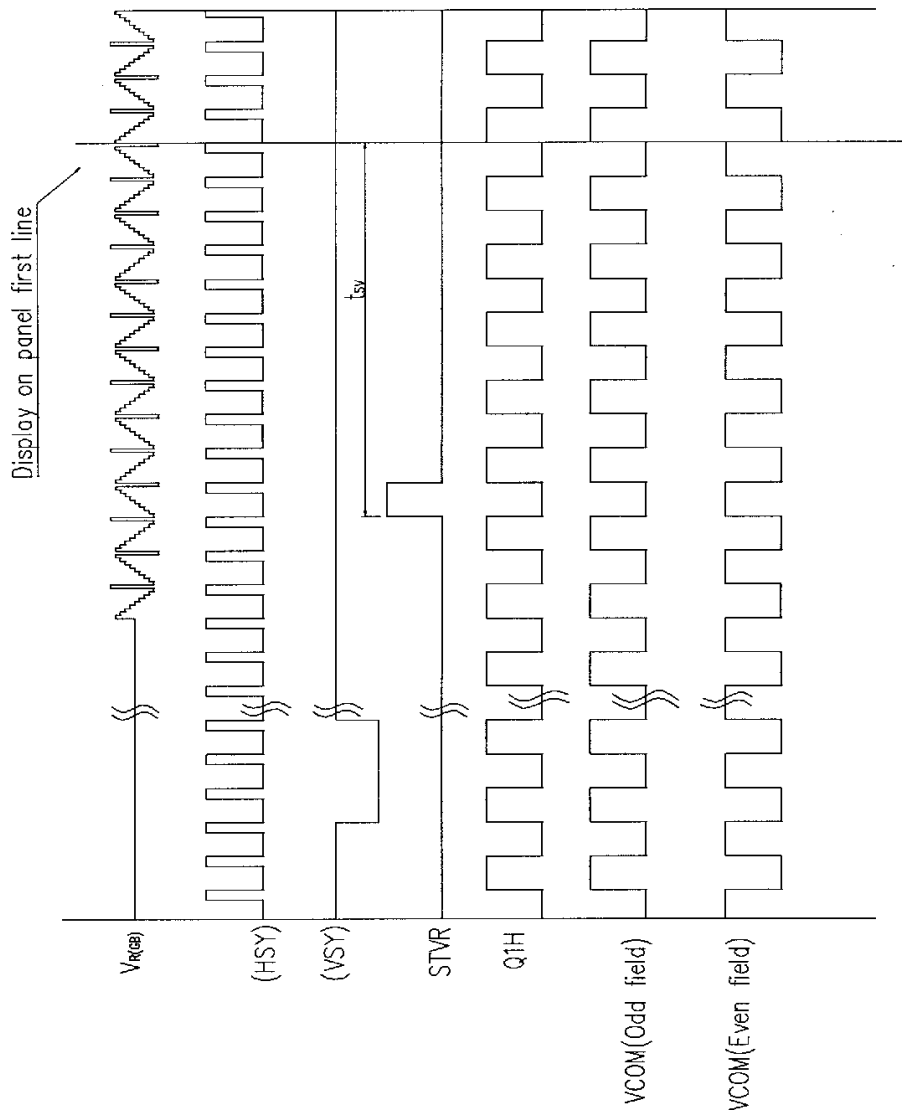


FIG5:



Vertical timing (From up to down)

FIG5-1:



Vertical timing (From down to up)

## 8. Pin connections

(a). TFT-LCD panel driving section

| Pin no | Symbol           | I/O | Description                                       | Remark  |
|--------|------------------|-----|---|---------|
| 1      | GND              | -   | Ground for logic circuit                          |         |
| 2      | V <sub>CC</sub>  | I   | Supply voltage for logic control circuit          |         |
| 3      | V <sub>GL</sub>  | I   | Negative power for scan driver                    |         |
| 4      | V <sub>GH</sub>  | I   | Positive power for scan driver                    |         |
| 5      | STVR             | I/O | Vertical start pulse                              | Note1   |
| 6      | STVL             | I/O | Vertical start pulse                              | Note1   |
| 7      | CKV              | I   | Shift clock input for scan driver                 |         |
| 8      | U/D              | I   | UP/DOWN scan control input                        | Note1,2 |
| 9      | OEV              | I   | Output enable input for scan driver               |         |
| 10     | VCOM             | I   | Common electrode driving signal                   |         |
| 11     | VCOM             | I   | Common electrode driving signal                   |         |
| 12     | L/R              | I   | Left/Right scan control input                     | Note1,2 |
| 13     | Q1H              | I   | Analog signal rotate input                        |         |
| 14     | OEH              | I   | Output enable input for data driver               |         |
| 15     | STHL             | I/O | Start pulse for horizontal scan line              | Note1   |
| 16     | STHR             | I/O | Start pulse for horizontal scan line              | Note1   |
| 17     | CPH3             | I   | Sampling and shifting clock pulse for data driver |         |
| 18     | CPH2             | I   | Sampling and shifting clock pulse for data driver |         |
| 19     | CPH1             | I   | Sampling and shifting clock pulse for data driver |         |
| 20     | V <sub>CC</sub>  | I   | Supply voltage for logic control circuit          |         |
| 21     | GND              | -   | Ground for logic circuit                          |         |
| 22     | VR               | I   | Alternated video signal input (Red)               |         |
| 23     | VG               | I   | Alternated video signal input (Green)             |         |
| 24     | VB               | I   | Alternated video signal input (Blue)              |         |
| 25     | AV <sub>DD</sub> | I   | Supply voltage for analog circuit                 |         |
| 26     | AV <sub>SS</sub> | I   | Ground for analog circuit                         |         |

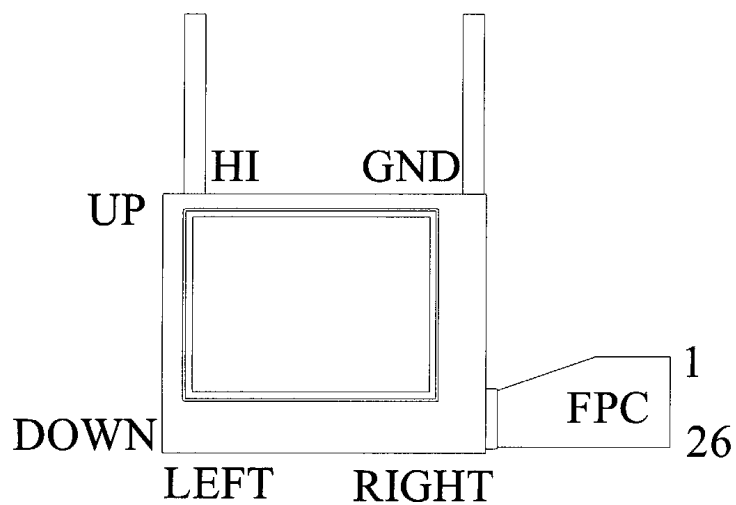
Note 1: Selection of scanning mode (please refer to the following table)

| Setting of scan control input |     | IN/OUT state<br>For start pulse |      |      |      | Scanning direction                       |
|-------------------------------|-----|---------------------------------|------|------|------|--|
| U/D                           | L/R | STVR                            | STVL | STHR | STHL |  |
| GND                           | Vcc | OUT                             | IN   | OUT  | IN   | From up to down, and from left to right. |
| Vcc                           | GND | IN                              | OUT  | IN   | OUT  | From down to up, and from right to left. |
| GND                           | GND | OUT                             | IN   | IN   | OUT  | From up to down, and from right to left. |
| Vcc                           | Vcc | IN                              | OUT  | OUT  | IN   | From down to up, and from left to right. |

IN: Input; OUT: Output.

Note 2: Definition of scanning direction

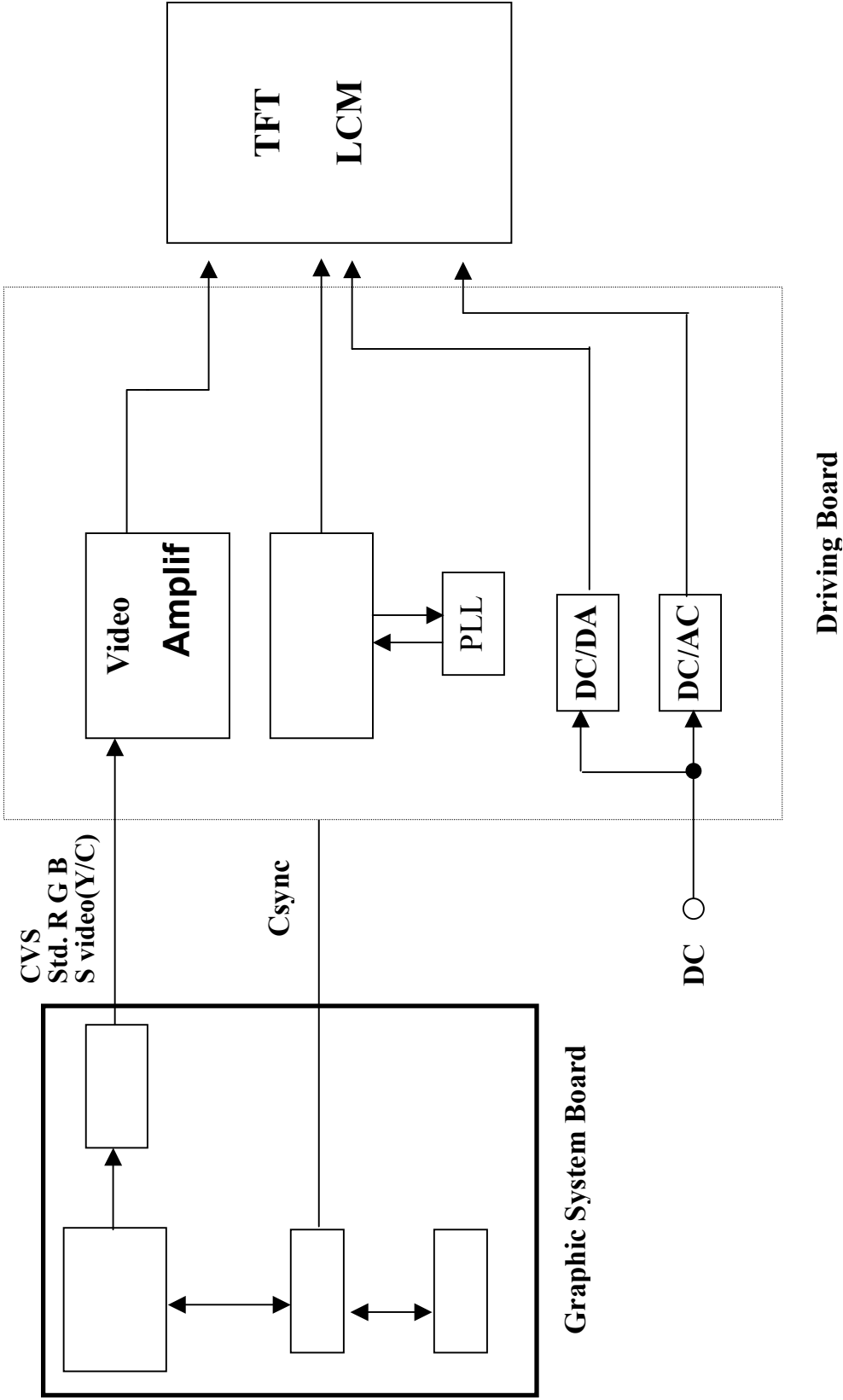
Refer to figure as below:



(b) Backlight driving section

| No. | Symbol | I/O | Description                           | Remark |
|-----|--------|-----|---------------------------------------|--------|
| 1   | GND    | -   | Ground                                |        |
| 4   | HI     | I   | Power supply for backlight unit (LED) |        |

# 9. Block diagram



RELATED BLOCK DIAGRAM

## 10. QUALITY ASSURANCE

### 10.1 Test Condition

#### 10.1.1 Temperature and Humidity(Ambient Temperature)

Temperature :  $20 \pm 5^{\circ}\text{C}$

Humidity :  $65 \pm 5\%$

#### 10.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

#### 10.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

#### 10.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

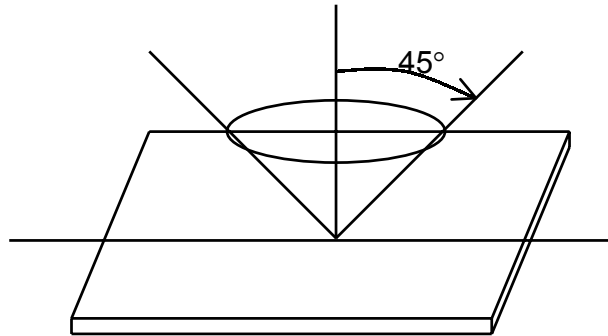
#### 10.1.5 Test Method

| No. | Reliability Test Item & Level                     | Test Level   |
|-----|---|--|
| 1   | High Temperature Storage Test                     | T=80°C,240hrs  |
| 2   | Low Temperature Storage Test                      | T=-25°C,240hrs   |
| 3   | High Temperature Operation Test                   | T=60°C,240hrs  |
| 4   | Low Temperature Operation Test                    | T=0°C,240hrs   |
| 5   | High Temperature and High Humidity Operation Test | T=60°C,95% RH,240hrs   |
| 6   | Thermal Cycling Test<br>(No operation)            | -25°C → +25°C → +80°C,200 Cycles<br>30 min    5min    30 min   |
| 7   | Vibration Test<br>(No operation)                  | Frequency:10 ~ 55 Hz<br>Amplitude:1.0 mm<br>Sweep Time:11min<br>Test Period:6 Cycles for each Direction of X,Y,Z |
| 8   | Shock Test<br>(No operation)                      | 100G,6ms<br>Direction:± X,± Y,± Z<br>Cycle:3 times   |
| 9   | Electrostatic Discharge Test<br>(No operation)    | 150pF,330Ω<br>Air:± 15KV;Contact: ± 8KV<br>10 times/point;4 points/panel face                                    |

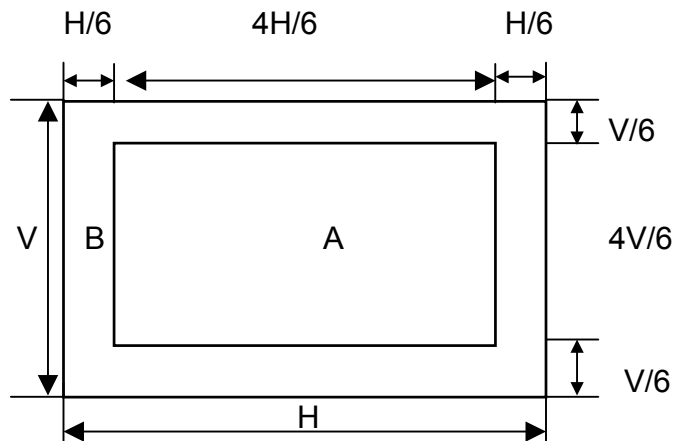
## 10.2 Inspection condition

### 10.2.1 Inspection conditions

The LCD shall be inspected under 40W white fluorescent light.  
 $\theta < 45^\circ$  inspection under non-operating condition.  
 $\theta < 5^\circ$  inspection under operating condition.



### 10.2.2 Definition of applicable Zones



10.2.3 Inspection Parameters

| No.                  | Parameter                           | Criteria  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|----------------------|-------------------------------------|---|--------|-------------------|-------------------|------------------|-----------|-------------------|------------------|-----------------------|---|-------|------|---------|-----------------------|-------|---|---------------------|---|--------------|--------------|---|
| 1                    | Operating                           | Display function: No Display malfunction (Major)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | Contrast ratio (Black, White) :<br>Does not meet specified range in the spec. (Major) (Note:3)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | Line Defect : No obvious Vertical and Horizontal line defect in bright, dark and colored. (Major)(Note:1)   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | Point Defect (red, green, blue, dark): Active area $\leq 5$ dots(Minor) (Note:1)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | <table border="1"> <thead> <tr> <th rowspan="2">Item</th> <th colspan="2">Acceptable number</th> <th rowspan="2">Total</th> </tr> <tr> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td>Bright</td> <td>0</td> <td>2</td> <td rowspan="3">5</td> </tr> <tr> <td>Dark</td> <td>2</td> <td>4</td> </tr> <tr> <td>Total</td> <td>2</td> <td>4</td> </tr> </tbody> </table>  | Item   | Acceptable number |                   | Total            | A         | B                 | Bright           | 0                     | 2 | 5     | Dark | 2       | 4                     | Total | 2 | 4                   |   |              |              |   |
| Item                 | Acceptable number                   |   |        | Total             |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      | A                                   | B   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| Bright               | 0                                   | 2   | 5      |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| Dark                 | 2                                   | 4   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| Total                | 2                                   | 4   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | Non-uniformity: Visible through 2%ND filter. (Major)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| 2                    | External Inspection (non-operating) | Dimension: Outline (Major)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | Scratch on the polarizer: (Note:2)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | <table border="1"> <thead> <tr> <th rowspan="2">X (mm)</th> <th rowspan="2">Zone<br/>Y(mm)</th> <th>Acceptable number</th> <th rowspan="2">Class Of Defects</th> <th rowspan="2">AQL Level</th> </tr> <tr> <th></th> </tr> </thead> <tbody> <tr> <td><math>0.5 &lt; L \leq 5</math></td> <td><math>0.1 \leq W \leq 0.5</math></td> <td>1</td> <td rowspan="4">Minor</td> <td rowspan="4">1.5</td> </tr> <tr> <td><math>L &gt; 5</math></td> <td><math>0.1 \leq W \leq 0.5</math></td> <td>0</td> </tr> <tr> <td></td> <td><math>W &gt; 0.5</math></td> <td>0</td> </tr> <tr> <td><math>L \leq 0.5</math></td> <td><math>W \leq 0.1</math></td> <td>*</td> </tr> </tbody> </table> | X (mm) | Zone<br>Y(mm)     | Acceptable number | Class Of Defects | AQL Level |                   | $0.5 < L \leq 5$ | $0.1 \leq W \leq 0.5$ | 1 | Minor | 1.5  | $L > 5$ | $0.1 \leq W \leq 0.5$ | 0     |   | $W > 0.5$           | 0 | $L \leq 0.5$ | $W \leq 0.1$ | * |
|                      |                                     | X (mm)  |        |                   | Zone<br>Y(mm)     |                  |           | Acceptable number | Class Of Defects | AQL Level             |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     |   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| $0.5 < L \leq 5$     | $0.1 \leq W \leq 0.5$               | 1   | Minor  | 1.5               |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| $L > 5$              | $0.1 \leq W \leq 0.5$               | 0   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      | $W > 0.5$                           | 0   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| $L \leq 0.5$         | $W \leq 0.1$                        | *   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
| X : Length Y : Width |                                     |   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | Dent or bubble on the polarizer (Note:2)  |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | <table border="1"> <thead> <tr> <th rowspan="2">X (mm)</th> <th rowspan="2">Zone<br/>Y(mm)</th> <th>Acceptable number</th> <th rowspan="2">Class Of Defects</th> <th rowspan="2">AQL Level</th> </tr> <tr> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td><math>D \leq 0.25</math></td> <td>*</td> <td rowspan="3">Minor</td> <td rowspan="3">1.5</td> </tr> <tr> <td></td> <td><math>D &gt; 0.5</math></td> <td>0</td> </tr> <tr> <td></td> <td><math>0.25 &lt; D \leq 0.5</math></td> <td>1</td> </tr> </tbody> </table>   | X (mm) | Zone<br>Y(mm)     | Acceptable number | Class Of Defects | AQL Level |                   |                  | $D \leq 0.25$         | * | Minor | 1.5  |         | $D > 0.5$             | 0     |   | $0.25 < D \leq 0.5$ | 1 |              |              |   |
| X (mm)               | Zone<br>Y(mm)                       | Acceptable number   |        |                   | Class Of Defects  |                  |           | AQL Level         |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     |   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      | $D \leq 0.25$                       | *   | Minor  | 1.5               |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      | $D > 0.5$                           | 0   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      | $0.25 < D \leq 0.5$                 | 1   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |
|                      |                                     | * : Disregard   |        |                   |                   |                  |           |                   |                  |                       |   |       |      |         |                       |       |   |                     |   |              |              |   |

| Class of defects | AQL   | Definition   |
|------------------|-------|--|
| Major            | 0.65% | It is a defect that is likely to result in failure or to reduce materially the usability of the intended function. |
|                  | 1.00% | It is a defect that is likely to assembly size and not result in functioning problem.                              |
| Minor            | 2.5%  | It is a defect that will not result in functioning problem with deviation classified.                              |

Note:1. (a)Bright point defect is defined as point defect of R,G,B with area >1/2 pixel respectively and visible under 2% ND filter.

(b)Dark point defect is defined as visible by using 5%ND filter in full white pattern.

(c)Definition of distribution of point defect is as follows:

-minumum separation between dark point defects should be larger than 3mm.

-minumum separation between bright point defects should be larger than 5mm.

(d)Definition of joined bright point defect and joined dark point defect are as follows:

-Two or more joined bright point defects must be nil.

-Three joined dark point defects must be nil.

-Coupling of one dark and one bright point in junction is counted as one dark and bright spot with 1 pair maxmum.

-Two Joined dark point is counted as two dark point with 2 pair maxmum.

(e)The ambient illumination level is 300~500 lux.

Note:2 The external inspection should be conducted at the distance  $35 \pm 5$ cm between the eyes of inspctor and the panel .

Note:3 Luminance measurement for contrast ratio is at the distance  $50 \pm 5$ cm between the detective head and the panel with ambient illuminance less than 1 lux. Contrast ratio is obtained at optimum view angle.

### 10.3.sampling condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

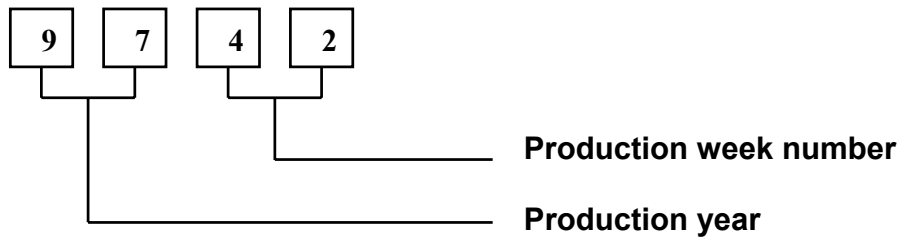
Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

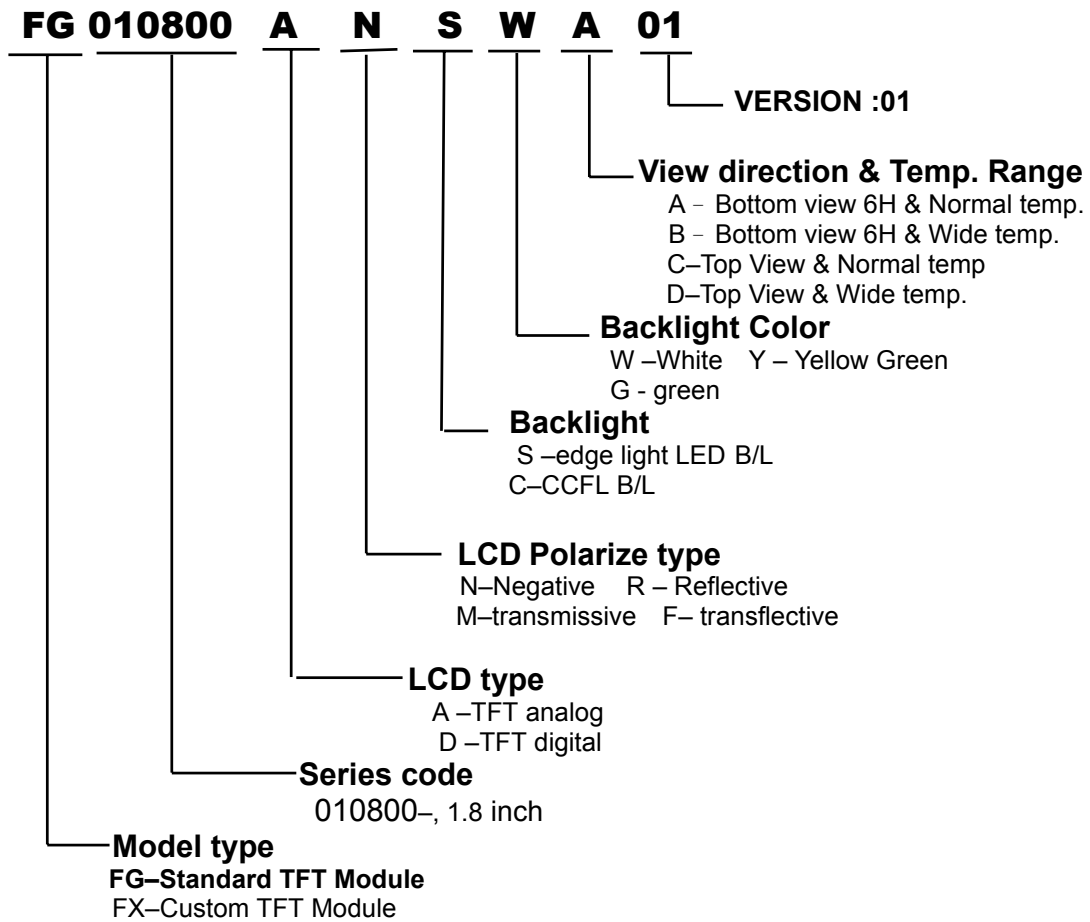
Inspection level: Level II

Sampling table: MIL-STD-105E

## 12. LOT NUMBERING SYSTEM



## 13. LCM NUMBERING SYSTEM



## 14. PRECAUTION FOR USING LCM

### 1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handling,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- (2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.
- (3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- (5). Do not drive LCD with DC voltage.

### 2. Liquid Crystal Display Modules

#### 2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

- (1). Do not tamper in any way with the tabs on the metal frame.
- (2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
- (3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
- (4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
- (5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

#### 2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

- (1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- (2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3). Only properly grounded soldering irons should be used.
- (4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.

- (5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
- (6). Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

### 2.3 Soldering

- (1). Solder only to the I/O terminals.
- (2). Use only soldering irons with proper grounding and no leakage.
- (3). Soldering temperature :  $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (4). Soldering time: 3 to 4 sec.
- (5). Use eutectic solder with resin flux fill.
- (6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

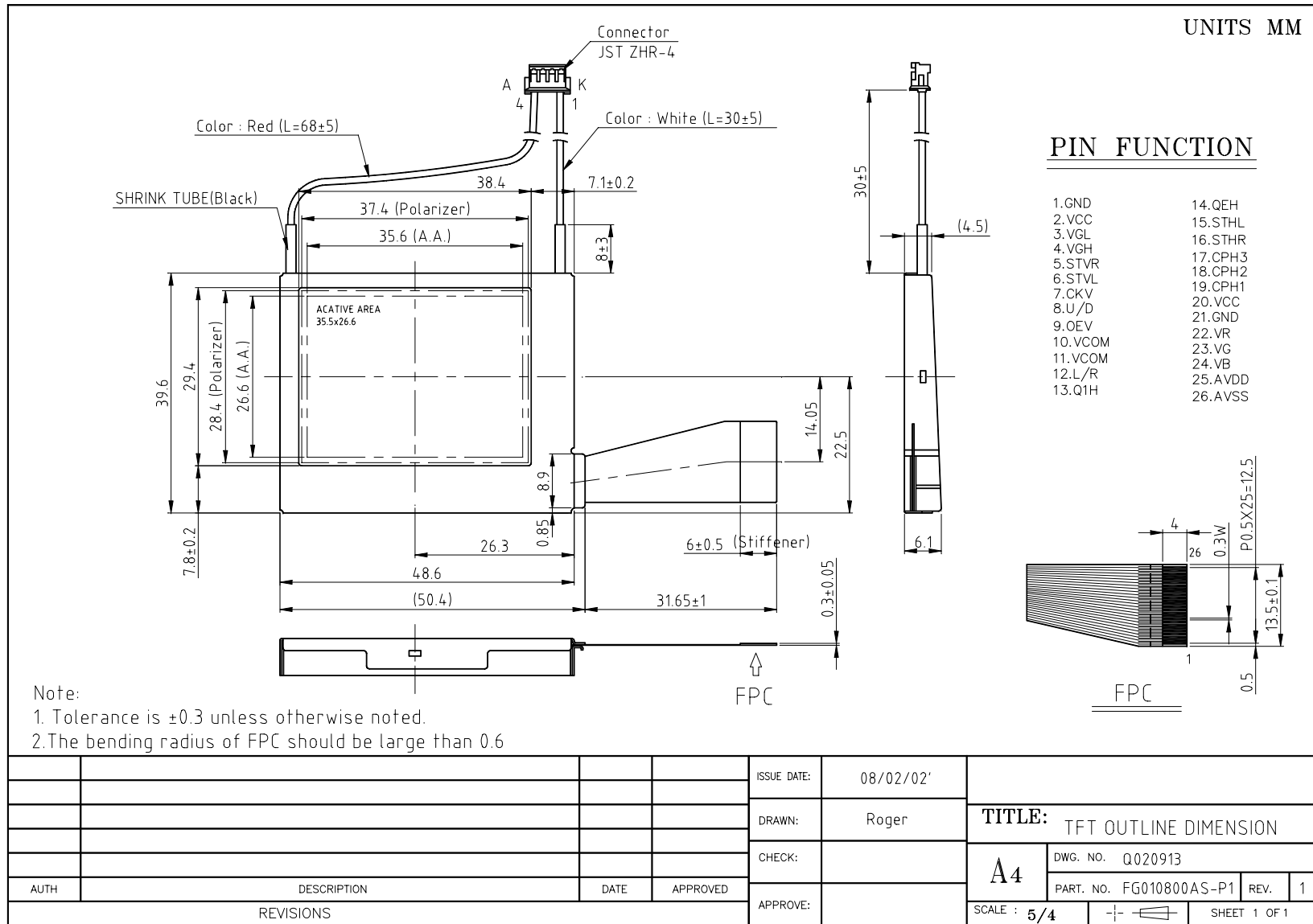
### 2.4 Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage  $V_0$ .
- (2). Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3). Response time increases with decrease in temperature.
- (4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- (5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

### 2.5 Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely

# 15. OUTLINE DRAWING



## 16.PACKAGE INFORMATION

