# FORMIKE ELECTRONIC CO.,LTD

# PRDUCT SPECIFICATON

## TFT LCD MODULE
## MODEL : KWH040GP03-F01  V 1.0

【　 】 Preliminary Specification
【 ◆ 】 Finally Specification

| CUSTOMER'S APPROVAL | |
| --- | --- |
| SIGNATURE: | DATE: |
| | |

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● This specification is subject to change withouth notice.Please contact FORMIKE or it's
  representative before designing your product based on this specification.

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# 1. GENERAL DESCRIPTION

KWH040GP03-F01 is a Transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs, FPC, and a backlight unit with bezel. The following table described the features of KWH040GP03

# 2. FEATURES

| Display Mode | Transmissive Type |
|---|---|
| | TFT LCD, Normally white |
| Display Format | RGB Strip type |
| Color | 16.7M color |
| Interface | RGB data bus, 24 bit parallel data |
| Viewing Direction | 6 O'clock |
| Backlight type / color | LED / White |

# 3. MECHANICAL SPECIFICATION

| Item | Specifications | Unit |
|---|---|---|
| Dimensional outline | 98.3(W)×62.6(H)×3.6(D)* | mm |
| Resolution | 480×3(R,G,B)×272 | dot |
| Active area | 87.84(W)×49.776(H) | mm |
| Pixel pitch | 0.183(W)×0.183(H) | mm |

＊ Exclude FPC

# 4. MECHANICALDIMENSION
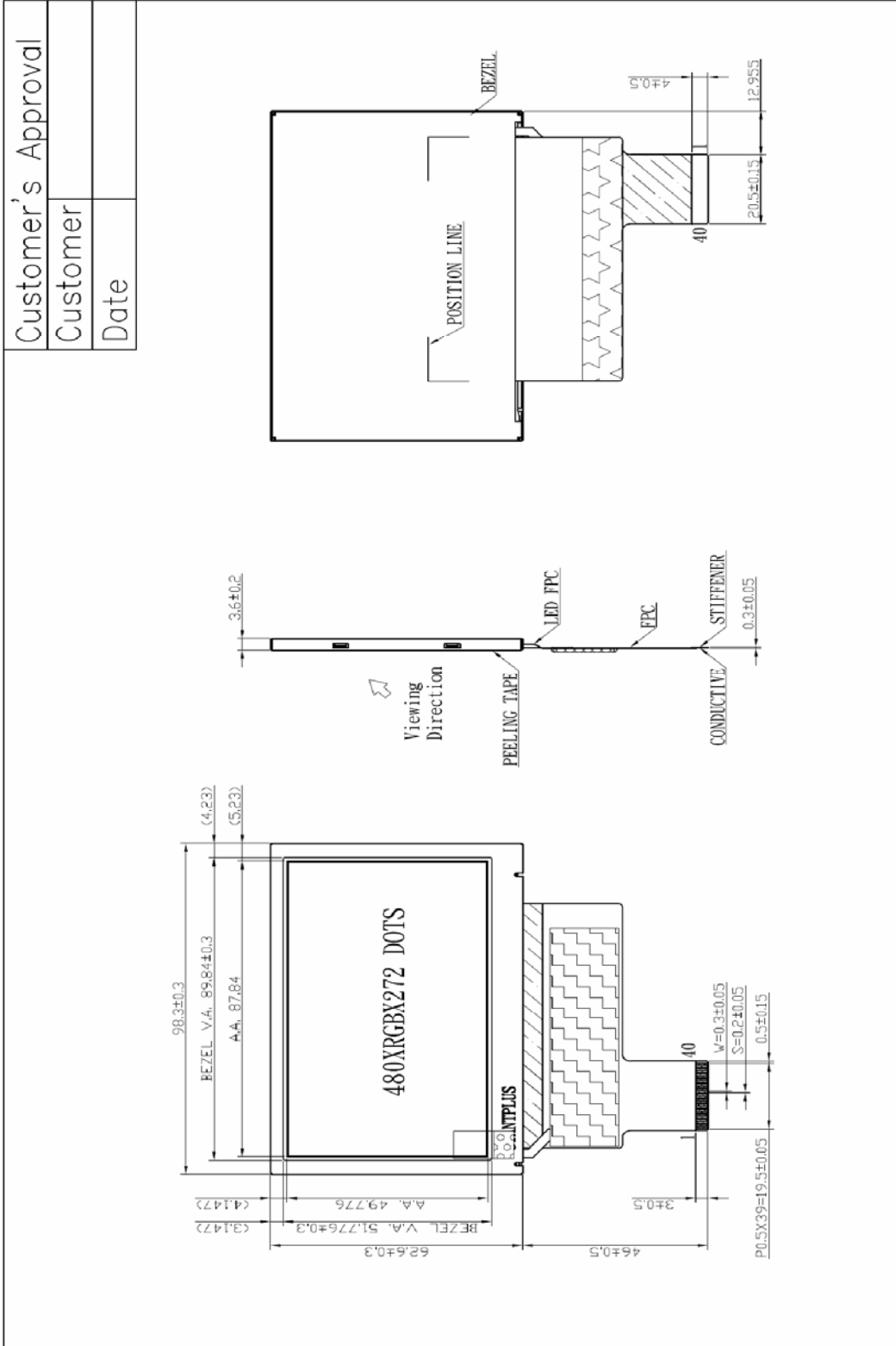
# 5. MAXIMUM RATINGS

| ITEM | SYMBOL | MIN. | MAX. | UNIT |
|------|--------|------|------|------|
| Power Supply Voltage | VDD | -0.3 | +6 | V |
| Operation Temperature | $T_{op}$ | -20 | 70 | ℃ |
| Storage Temperature | $T_{stg}$ | -30 | 80 | ℃ |
| Signal LED forward current | $I_F$ | - | 25 | mA |
| Signal LED pulse forward current | $I_{FP}$ | - | 140 | mA |
| Signal LED reverse current | $V_R$ | - | 5 | V |
| Humidity | - | - | 90 | %RH |

Note:

a. All of voltage listed above are with respective to GND=VSS=0V.

b. Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

c. Note1: $T_A \leq 40$℃  Without dewing

# 6. ELECTRICAL CHARACTERISTICS

## 6.1. TFT LCD Characteristic

Typical operating conditions                                                        (GND=AVSS=0V)

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|------|---|--------|------|------|------|------|------|
| Power supply | | VCC | 3.0 | 3.3 | 3.6 | V | |
| Current | | ICC | - | 30 | - | mA | |
| Analog Power supply | | AVDD | 4.8 | 5 | 5.2 | V | |
| Driver Input signal voltage | H | $V_{TH}$ | 0.7*VCC | - | VCC | V | |
| | L | $V_{TL}$ | 0 | - | 0.3*VCC | V | |

## 6.2. Backlight Characteristic

| Item | Symbol | Values | | | Unit | Remark |
|------|--------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| Power Consumption | $P_{LED}$ | - | 470 | - | mW | |
| LED Current | $I_L$ | 18 | 20 | 25 | mA | |
| LED Voltage | $V_L$ | (21.7) | (23) | (25.2) | V | |

Note: GP suggest using constant current driving this backlight unit.

# 7. MODULE FUNCTION DESCRIPTION

## 7.1. PIN Description

| Pin | Symbol | Description | Remark |
|---|---|---|---|
| 1 | VSS | Ground | |
| 2 | VSS | Ground | |
| 3 | VDD | Power supply | |
| 4 | VDD | Power supply | |
| 5 | R0 | Red data bit 0 | |
| 6 | R1 | Red data bit 1 | |
| 7 | R2 | Red data bit 2 | |
| 8 | R3 | Red data bit 3 | |
| 9 | R4 | Red data bit 4 | |
| 10 | R5 | Red data bit 5 | |
| 11 | R6 | Red data bit 6 | |
| 12 | R7 | Red data bit 7 | |
| 13 | G0 | Green data bit 0 | |
| 14 | G1 | Green data bit 1 | |
| 15 | G2 | Green data bit 2 | |
| 16 | G3 | Green data bit 3 | |
| 17 | G4 | Green data bit 4 | |
| 18 | G5 | Green data bit 5 | |
| 19 | G6 | Green data bit 6 | |
| 20 | G7 | Green data bit 7 | |
| 21 | B0 | Blue data bit 0 | |
| 22 | B1 | Blue data bit 1 | |
| 23 | B2 | Blue data bit 2 | |
| 24 | B3 | Blue data bit 3 | |
| 25 | B4 | Blue data bit 4 | |
| 26 | B5 | Blue data bit 5 | |
| 27 | B6 | Blue data bit 6 | |
| 28 | B7 | Blue data bit 7 | |
| 29 | VSS | Ground | |
| 30 | DCLK | Dot data clock input | |

| 31 | DISP | Display on/off control | Note1 |
|----|------|------------------------|-------|
| 32 | HSYNC | Horizontal sync input | |
| 33 | VSYNC | Vertical sync input | |
| 34 | DE | Data enable control | Note2 |
| 35 | VDD | Power supply | |
| 36 | NC | | |
| 37 | VSS | Ground | |
| 38 | VSS | Ground | |
| 39 | LED- | LED ground | |
| 40 | LED+ | LED power | |

**Note:**
1. DISP set "High", input data are valid. DISP set "Low", input data are invalid .
2. DE is "High",data can be access. DE is "Low",data can not be access..

## 7.2. Timing characteristics

### 7.2.1.Timing Chart.
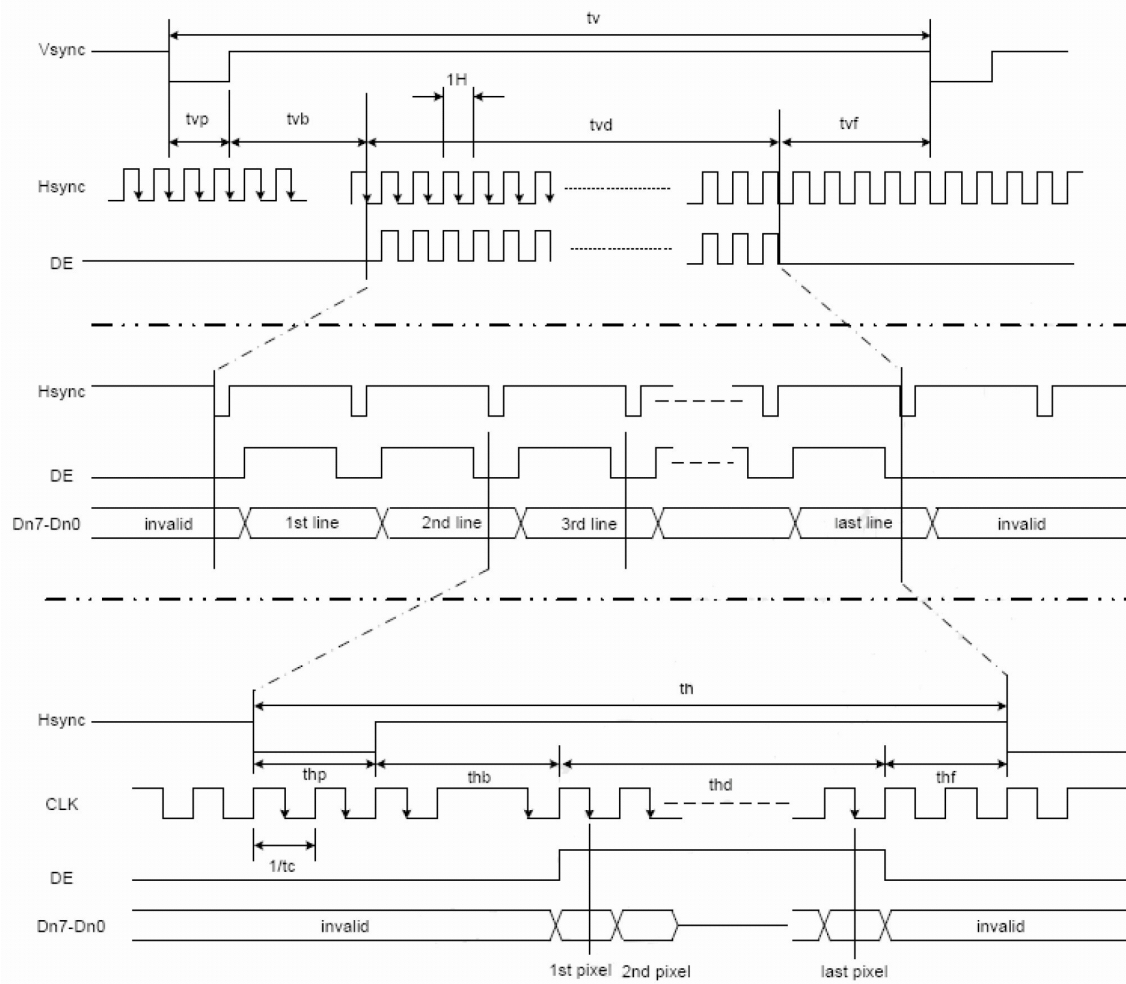
### 7.2.2.Timing Specification

| Item | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| CLK/Hsync /Vsync | CLK cycle | $1/t_C$ | - | 9 | 15 | MHz |
| | Hsync cycle | 1/th | - | 17.14 | - | KHz |
| | Vsync cycle | 1/tv | - | 59.94 | - | Hz |
| Horizontal cycle | Horizontal cycle | th | | 525 | | CLK |
| | Horizontal display period | thd | | 480 | | CLK |
| | Horizontal front porch | thf | 2 | - | - | CLK |
| | Horizontal pulse width | thp | 2 | 41 | - | CLK |
| | Horizontal back porch | thb | 2 | 2 | - | CLK |
| Vertical cycle | Vertical cycle | tv | - | 286 | - | H |
| | Vertical display period | tvd | - | 272 | - | H |
| | Vertical front porch | tvf | 2 | 2 | - | H |
| | Vertical pulse width | tvp | 2 | 10 | - | H |
| | Vertical back porch | tvb | 2 | 2 | - | H |

### 7.2.3.Color data Assignment

| COLOR | INPUT DATA | R DATA | | | | | | | | G DATA | | | | | | | | B DATA | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R7 MSB | R6 | R5 | R4 | R3 | R2 | R1 | R0 LSB | G7 MSB | G6 | G5 | G4 | G3 | G2 | G1 | G0 LSB | B7 MSB | B6 | B5 | B4 | B3 | B2 | B1 | B0 LSB |
| BASIC COLOR | 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(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 |
| | 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 |
| | 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 |
| | 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 |
| RED | RED(0) | 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(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 |
| GREEN | GREEN(0) | 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(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 |
| BLUE | BLUE(0) | 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(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 |

# 8. ELECTRO-OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1.

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|------|------|--------|-----------|-----|-----|-----|------|--------|
| Brightness | | | | 240 | 320 | - | cd/m$^2$ | |
| Response time | | $T_R + T_F$ | $\Theta=0$ | - | 35 | 50 | ms | Note 2 |
| Contrast ratio | | CR | At the center point of A.A. | 250 | 300 | - | - | Note 3 |
| Color Chromaticity | White | $W_x$ | $\Theta=0$ | (0.273) | (0.313) | (0.353) | - | Note 4 |
| | | $W_y$ | | (0.289) | (0.329) | (0.369) | | |
| Viewing Angle | Horizontal | - | $CR \geqq 10$ | 100 | 120 | - | Degree | Note 5 |
| | Vertical | - | | 90 | 105 | - | | |

Ta=25±2℃

Note:

1.  Test equipment setup

    After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A with a viewing angle of 2° at a distance of 50cm and normal direction.

2.  Definition of response time: $T_R$ and $T_F$

    The figure below is the output signal of the photo detector.
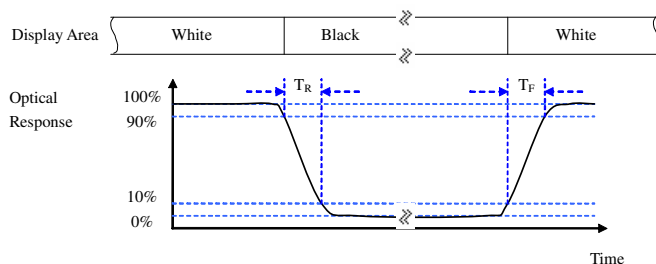
3.   Definition of contrast ratio:

Contrast ratio (CR) = $\dfrac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$

White $V_i = V_{i50\%} \pm 1.5V$

Black $V_i = V_{i50\%} \mu 2.0V$

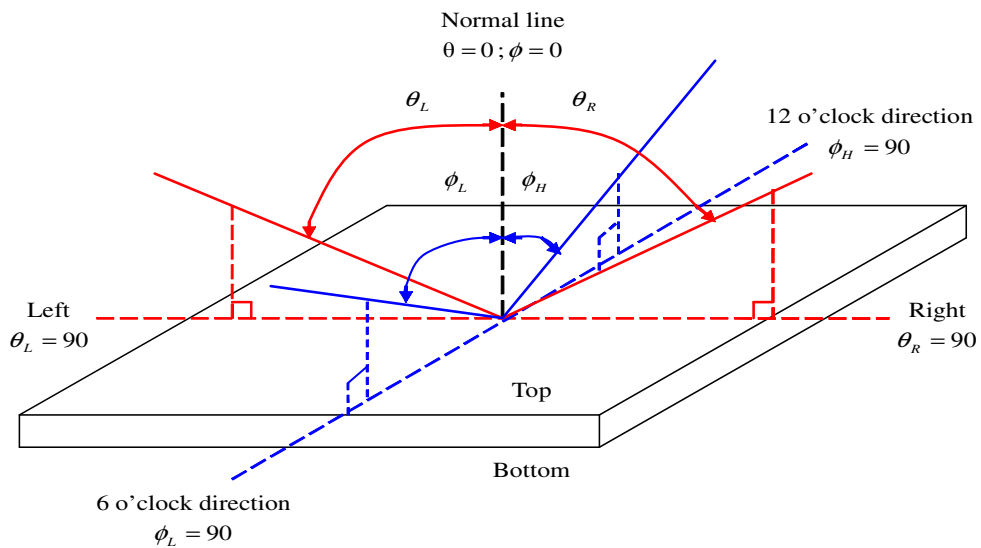"±" means that the analog input signal swings in phase with VCOM signal.

"μ" means that the analog input signal swings out of phase with VCOM signal.

Vi50%: 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.

4.   Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.
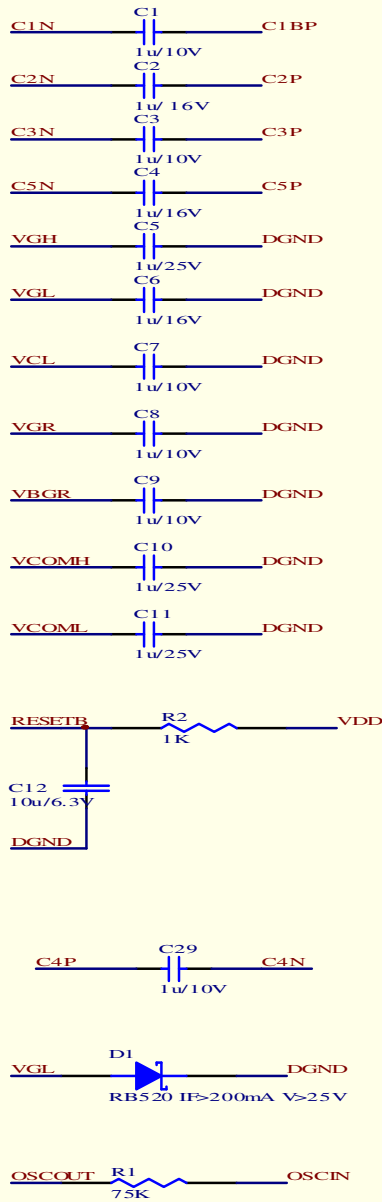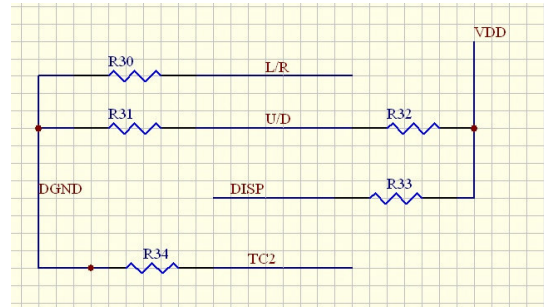
5.   Definition of viewing angle:

# 9. APPLICATION NOTE

**Application Circuit**

| | | |
|---|---|---|
| C1N | C1 1u/10V | C1BP |
| C2N | C2 1u/16V | C2P |
| C3N | C3 1u/10V | C3P |
| C5N | C4 1u/16V | C5P |
| VGH | C5 1u/25V | DGND |
| VGL | C6 1u/16V | DGND |
| VCL | C7 1u/10V | DGND |
| VGR | C8 1u/10V | DGND |
| VBGR | C9 1u/10V | DGND |
| VCOMH | C10 1u/25V | DGND |
| VCOML | C11 1u/25V | DGND |

RESETB — R2 1K — VDD
C12 10u/6.3V
DGND

C4P — C29 1u/10V — C4N

VGL — D1 — DGND
RB520 IF>200mA V>25V

OSCOUT — R1 75K — OSCIN

**Interface selection**

R30 — L/R
R31 — U/D — R32
DGND — DISP — R33 — VDD
R34 — TC2

# 10. RELIABILITY

## 10.1.MTTF

The LCD module shall be designed to meet a minimum MTTF value of 50,000 hours with normal condition. (25℃ in the room without sunlight; not include life time of backlight)

## 10.2.Tests

| NO. | ITEM | CONDITION | CRITERION |
|---|---|---|---|
| 1 | High Temperature Operating | 70℃    240 hrs | ◦ No Defect Of Operational Function In Room Temperature Are Allowable.

◦ Leakage current should be below double of initial value. |
| 2 | Low Temperature Operating | -20℃    240 hrs | |
| 3 | High Temperature Non-Operating | 80℃    240 hrs | |
| 4 | Low Temperature Non-Operating | -30℃    240 hrs | |
| 5 | High Temperature/ Humidity Non-Operating | 50℃ ,90%RH   240 hrs | |
| 6 | Temperature Shock Non-Operating | -30℃ ⟷ 80℃ ( 30min ) ( 5min ) ( 30min ) 10 CYCLES | |
| 7 | Electrostatic Discharge Test Non-Operating | HBM:±2KV | |

Note 1: Test after 24 hours in room temperature.
Note 2: The sampling above is individually for each reliability testing condition.
Note 3: The color fading of polarizing filter should not care.
Note 4: All of the reliability testing chamber above, is using D.I. water.(Min value: 1.0 MΩ-cm)
Note 5: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

## 10.3.Color performance

| No. | ITEM | Criterion (initial) |
|---|---|---|
| 1 | Luminance | >50% |
| 2 | NTSC | >70% |
| 3 | Contrast Ratio | >50% |

# 11. INSPECTION CRITERIA

## 11.1. Inspection Conditions

### 11.1.1. Environmental conditions

The environmental conditions for inspection shall be as follows

Room temperature: 23±5℃

Humidity: 50±20%RH

### 11.1.2. The external visual inspection

With a single 1000±200lux fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

## 11.2. Light Method

### 11.2.1. Environment lamp under 1000±200 lux, Viewing direction for inspection over 30 ㎝.

### 11.2.2. The distance from eye to defect around 300mm, the distance from ND Filter to defect around 25~30mm.
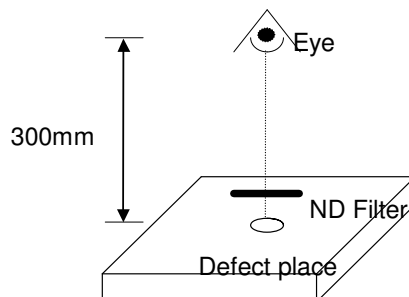
## 11.3. Classification Of Defects

### 11.3.1. Major defect

A major defect refers to a defect that may substantially degrade usability for product applications.

### 11.3.2. Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.
Notes: If the LCD/LCM 's cosmetic and display performance do not specify in "inspection criterion", it should be based on these delivered samples.
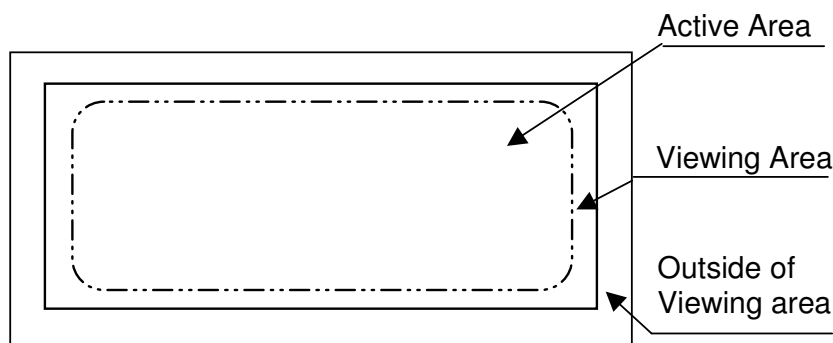
## 11.4. Sampling & Acceptable Quality Level

Level II, MIL-STD-105E

| Inspection Item | Major defect | Minor defect |
|-----------------|--------------|--------------|
| Cosmetic | 1.0% | 1.5% |
| Electrical test | 0.4% | 0.65% |

## 11.5. Definition Of Inspection Area
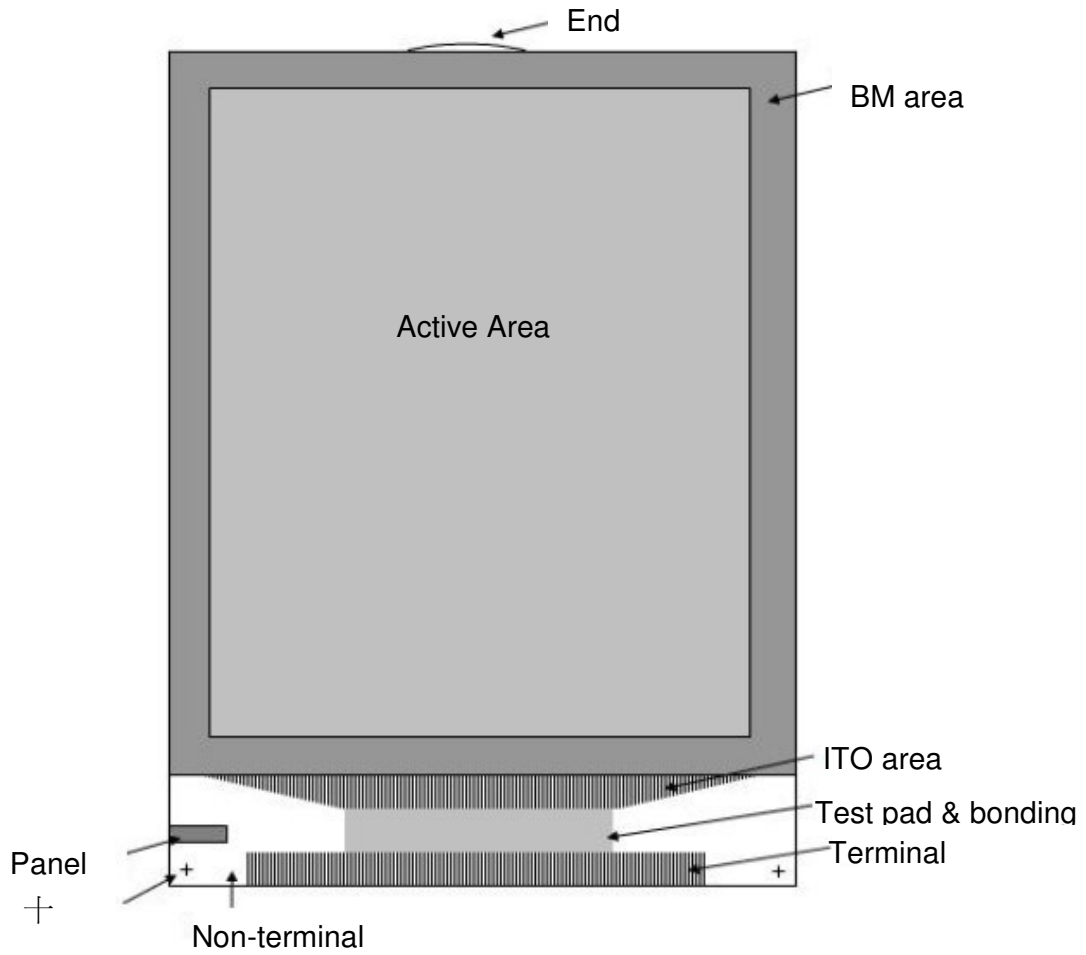
V.A: Viewing Area

A.A: Active Area

## 11.6.V.A: Viewing Area

A.A: Active Area

# 11.7.Items And Criteria

### 11.7.1.  Visual inspection criterion in cosmetic

(1) Glass defect

| No | Defect | Criteria | Remark |
|----|--------|----------|--------|
| 1 | Dimension<br><br>(Minor) | By engineering diagram |  |
| 2 | Cracks<br><br>(Major) | Extensive crack 【Reject】 |  |

(2) LCM appearance defect with in V.A

| No | Defect | Criteria | | Remark |
|----|--------|----------|---|--------|
| 1 | Round type<br>(Minor) | Spec. | Permissible Qty | 1. $\phi$ =(L+W)/2, L: Length, W: Width<br>2. Disregard if out of V.A. |
| | | $\phi \leqq 0.20$mm | Disregard | |
| | | 0.20mm< $\phi \leqq 0.45$mm | 4 | |
| | | 0.45mm< $\phi$ | 0 | |
| 2 | Line type<br><br>(Minor) | Spec. | Permissible Qty | 1. L: Length, W: Width<br>2. Disregard if out of V.A. |
| | | L$\leqq$6.0mm and W$\leqq$0.1mm | Disregard | |
| | | L$\leqq$6.0mm and<br>0.10mm<W$\leqq$0.25mm | 3 | |
| | | W>0.25mm or L>6.0mm | 0 | |
| 3 | Polarizer dent<br>(Minor) | Spec. | Permissible Qty | 1. $\phi$ =(L+W)/2 , L: Length, W: Width |
| | | $\phi \leqq 0.30$mm | Disregard | 2. Disregard if out of V.A. |
| | | 0.30mm< $\phi \leqq 0.50$mm | 2 | |
| | | 0.50mm< $\phi \leqq 0.80$mm | 1 | |
| | | 0.80mm< $\phi$ | 0 | |

(3) FPC

| No | Defect | Criteria | Remark |
|----|--------|----------|--------|
| 1 | Copper peeling (Minor) | Copper peeling 【Reject】 | |

(4) Black tape

| No | Defect | Criteria | Remark |
|----|--------|----------|--------|
| 1 | Shift (Minor) | IC exposed 【Reject】 | |
| 2 | No black tape (Minor) | No black tape 【Reject】 | |

(5) Silicon

| No | Defect | Criteria | Remark |
|----|--------|----------|--------|
| 1 | Amount of silicon (Minor) | ITO exposed 【Reject】 | |

(6) Bezel

| No | Defect | Criteria | Remark |
|----|--------|----------|--------|
| 1 | Oxidized spot (Minor) | Oxidized spot, rust 【Reject】 | |
| 2 | Outline deformation (Minor) | By engineering diagram | |
| 3 | Greasiness (Minor) | Greasiness 【Reject】 | |
| 4 | Spots, round Type (Minor) | H≦By engineering diagram 【Disregard】 | H=Total height (thickness) |
| 5 | Plating (Minor) | Bubble, peeling 【Reject】 | |

### 11.7.2. Electrical criterion

| No | Defect | Criteria | | | | Remark |
|---|---|---|---|---|---|---|
| 1 | No display (Major) | Not allowed | | | |  |
| 2 | Missing line (Major) | Not allowed | | | |  |
| 3 | Darker or lighter line (Major) | Not allowed | | | |  |
| 4 | Weak line (Minor) | By limited sample | | | | |
| 5 | Bright / Dark point (Minor) | | A Area | B Area | Total | 1:1sub-pixel: 1R or 1G or 1B |
| | | Bright point | 0 | 2 | 2 | 2:Point defect area $\geqq$ 1/2 sub pixel. |
| | | Dark dot point | 2 | 3 | 3 |  |
| | | Bright +Dark point | 2 | 3 | 4 | |
| 6 | Round type (Minor) | Spec. | | | Permissible Qty | 1. $\phi$ =(L+W)/2, L: Length, W: Width |
| | | $\phi \leqq$ 0.20mm | | | Disregard | 2. Disregard if out of A.A. |
| | | 0.20mm< $\phi \leqq$ 0.45mm | | | 4 |  |
| | | 0.45mm< $\phi$ | | | 0 | |
| 7 | Line type (Minor) | Spec. | | | Permissible Qty | 1. L: Length, W: Width |
| | | L $\leqq$ 6.0mm and W $\leqq$ 0.1mm | | | Disregard | 2. Disregard if out of A.A. |
| | | L $\leqq$ 6.0mm and 0.10mm<W $\leqq$ 0.25mm | | | 3 |  |
| | | W>0.25mm or L>6.0mm | | | 0 | |

| No | Defect | Criteria | Remark |
|---|---|---|---|
| 8 | Mura (Minor) | By 5% ND filter invisible | |

11.7.3. Others
1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

# 13. RoHS COMPLIANT WARRANTY

RoHs Hazardous substances including:
- Cd< 100 ppm
- Pb< 1000 ppm
- Hg< 1000 ppm
- Cr +6 < 1000 ppm
- PBDE < 1000 ppm
- PBB < 1000 ppm

# 14. PRECAUTIONS FOR USE

## 14.1. Safety

(1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.

(2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.

(3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

## 14.2. Storage Conditions

(1) Store the panel or module in a dark place where the temperature is 23±5°C and the humidity is below 50±20%RH.

(2) Store in anti-static electricity container.

(3) Store in clean environment, free from dust, active gas, and solvent.

(4) Do not place the module near organics solvents or corrosive gases.

(5) Do not crush, shake, or jolt the module.

(6) Do not expose to direct sun light of fluorescent lamps.

## 14.3. Installing LCD Module

Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.

(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements.    The measurement tolerance should be ±0.1mm.

## 14.4. Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.

(2) Driving the LCD in the voltage above the limit will shorten its lifetime.

(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.

(4) When turning the power on, input each signal after the positive/negative voltage becomes stable.

(5) Do not apply water or any liquid on product, which composed of T/P.

## 14.5. Handling Precautions

(1) Avoid static electricity that can damage the CMOS LSI; please wear the wrist strap when handling.

(2) The polarizing plate of the display is very fragile. so, please handle it very carefully.

(3) Do not give external shock.

(4) Do not apply excessive force on the surface; it may cause display abnormal.

(5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

(6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

(7) Do not operate it above the absolute maximum rating.

(8) Do not remove the panel or frame from the module.

(9) Do not apply water or any liquid on product, which composed of T/P.

## 14.6. Warranty

14.6.1. The period is within 12 months since the date of shipping out under normal using and storage conditions.

14.6.2. The warranty will be avoided in case of defect induced by customer.