# ChunghwaPictureTubes,Ltd. ProductSpecification

*TFT LCD*

## CLAA070JA05CW

**ACCEPTED BY : (V0.3)**

**Tentative**

| APPROVED BY | CHECKED BY | PREPARED BY |
|---|---|---|
| | | |

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|---|---|---|---|

# REVISION STATUS

| Revision Notice | Description | Page | Rev. Date |
|---|---|---|---|
| 0.0 | First revision (Tentative) | -- | 2006/12/11 |
| 0.1 | Revise VCOM-DC | P6 | 2007/01/05 |
| 0.2 | ADD NTSC | P13 | 2007/02/02 |
| 0.3 | Revise Inverter Frequency | P7 | 2007/07/30 |

# CONTENTS

# 1. OVERVIEW

**CLAA070JA05CW** is 17.67cm(7") color TFT-LCD (Thin Film Transistor Liquid Crystal
Display) module composed of LCD panel, driver ICs and backlight.

The 17.67cm(7") screen produces 480(*3)X234 WQVGA resolution image. By applying
R.G.B. input signal, full color images are displayed. Inverter for backlight is not included in
this module.

General specifications are summarized in the following table:

| ITEM | ECIFICATION |
|---|---|
| Display Area (mm) | 154.08 (H) × 86.58 (V) |
| Number of Pixels | 480(H) × 3(RGB)× 234(V) |
| Pixel Pitch (mm) | 0.321(H)×0.37(V) |
| Color Pixel Arrangement | RGB vertical stripe |
| Display Mode | Normally white,TN |
| Number of color | Full color |
| Viewing Direction | 6 o'clock |
| Brightness(cd/㎡) | 350 ( $I_L$=6.0 mA) |
| Power Consumption(W) | 3.6 (Typ.) |
| Outline Dimension(mm) | 164.9(W) × 100.0(H) × 5.7(D) |
| module weight(g) | 160(Max.) |
| BL unit | CCFL (*1 tube) |
| Surface Treatment | Anti-Glare |

# 2. ABSOLUTE MAXIMUM RATINGS

| ITEM | SYMBOL | conditions | MIN. | MAX. | UNIT | Note |
|---|---|---|---|---|---|---|
| Power Supply Voltage for LCD | VCC | GND=0 | -0.3 | 6 | V | |
| | AVDD | AVSS=0 | -0.3 | 7 | V | |
| | VGH | GND=0 | -0.3 | 40 | V | |
| | VGL | | -20 | 0.3 | V | |
| Signal input voltage | Vi | | -0.2 | AVDD+0.2 | V | Note1 |
| | VI | | -0.3 | VCC+0.3 | V | Note2 |

Note1：Analog input voltage VR, VG, VB
Note2：Logical signal STHL, STHR, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.
Note3：If the relative temperature and humidity out of range too long, it will affect visual quality of LCD.
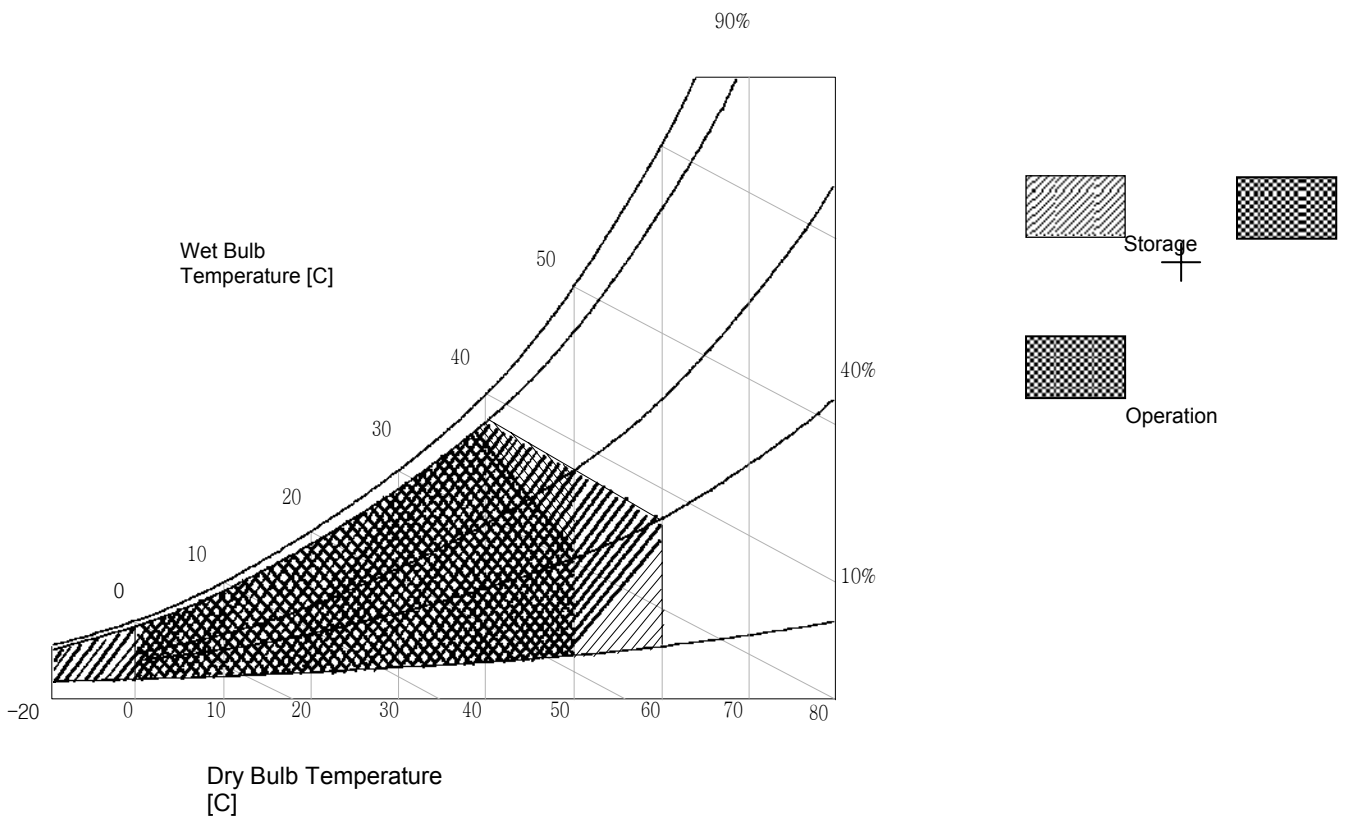
# 3. ELECTRICAL CHARACTERISTICS

## 3.1 Typical operation conditions

GND = Avss = 0V　(Ta=25℃ )

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | Note |
|---|---|---|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 4.5 | 5 | 5.5 | V | |
| | $AV_{DD}$ | 4.5 | 5 | 5.5 | V | |
| | $V_{GH}$ | 17 | 18 | 19 | V | |
| | $V_{GL}$ | -7 | -6 | -5 | V | |
| Signal Amplitude (VR, VG, VB) | $V_{iA}$ | 0.4 | - | $AV_{DD}$-0.4 | V | Note1 |
| | $V_{iAC}$ | - | 4 | - | V | Note1 |
| | $V_{iDC}$ | - | $AV_{DD}$/2 | - | V | Note1 |
| VCOM | $V_{CAC}$ | 4 | 4.88 | 6 | $V_{P-P}$ | Note1,2 |
| | $V_{CDC}$ | 1.85 | 1.95 | 2.05 | V | Note1,3 |
| Input Signal Voltage | $V_{IH}$ | $0.7V_{CC}$ | - | VCC | V | Note4 |
| | $V_{IL}$ | 0 | - | $0.3V_{CC}$ | V | |

Note1：Please refer to Fig.1
Note2：Brightness level is adjusted by varying this amplitude $V_{CAC}$
Note3：Please adjust $V_{CDC}$ to make the flicker level be minimum.
Note4：Logical signal STHL,STHR,OEH,L/R,CPH1~CPH3,STVR,STVL,OEV,CKV,U/D.
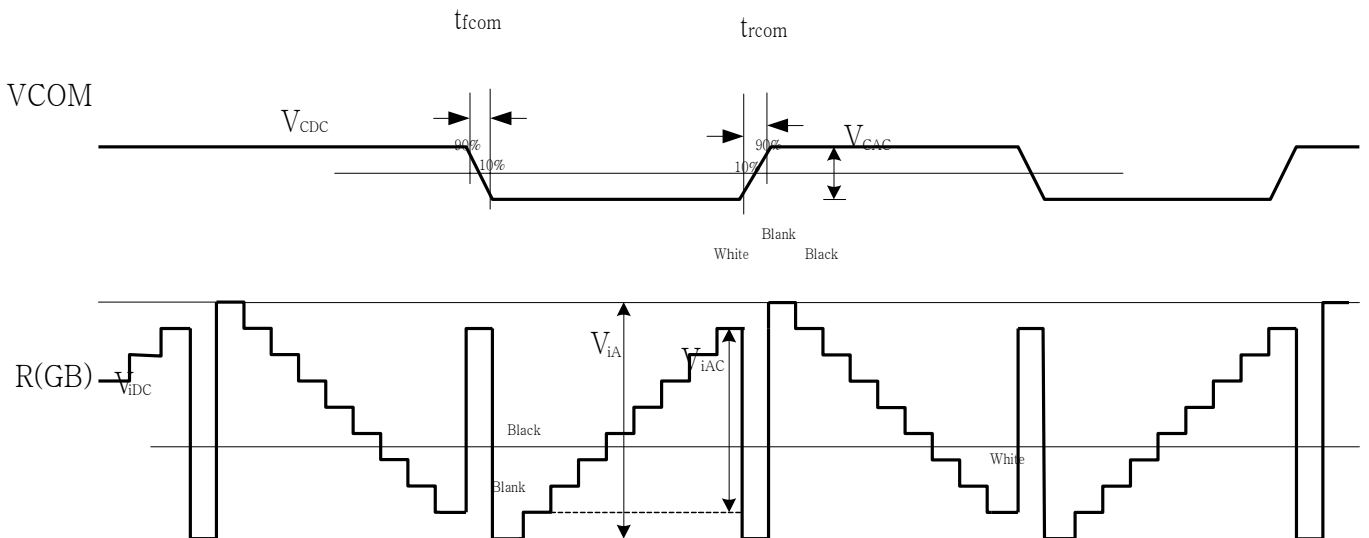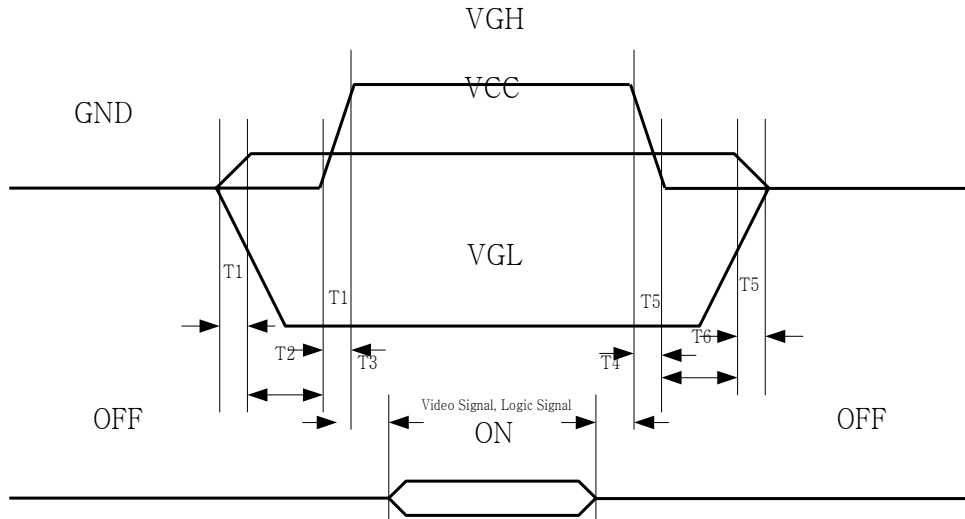Note5：Power sequence refer to Fig.2



Fig.1 VCOM-RGB

T1 $\leqq$ 15ms (From 10%*VCC to 90%*VCC, when VCC is Low to High);

T2 $\leqq$ 10ms (From 90%*VCC to 10%*VGH, when VCC is Low to High);

T3 $\leqq$ 10ms (From 90%*VGH to Video Signal, when VGH is Low to High);

T4 $\leqq$ 10ms (From Video signal to 90%*VGH, when VGH is High to Low);

T5 $\leqq$ 20ms (From 90%*VCC to 10%*VCC, when VCC is High to Low);

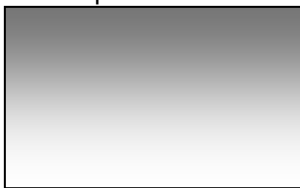T6 $\leqq$ 10ms (From 10%*VGH to 90%*VCC, when VCC is Low to High);

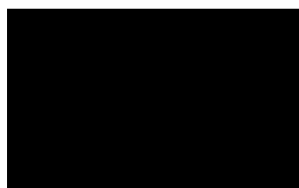Fig.2 Power Sequence

## 3.2 Current consumption

(GND = Avss = 0V )

| ITEM | SYMBOL | conditions | MIN. | TYP. | MAX. | UNIT | Note |
|---|---|---|---|---|---|---|---|
| Drive Current | $I_{GH}$ | $V_{GH}$ =18V | - | 60 | 65 | µA | Note1 |
| | $I_{GI}$ | $V_{GI}$ = -6V | - | 62 | 67 | µA | Note1 |
| | $I_{CC}$ | $V_{CC}$ = 5V | - | 11 | 22 | µA | Note1 |
| | $I_{DD}$ | $AV_{DD}$ = 5V | - | 8.3 | 21.6 | mA | Note1 |

Note1：Typ. specification：Gray-level test Pattern
Max. specification：Black test Pattern



(a)Gray-level Pattern          (b)Black Pattern

## 3.3 Backlight system

(Ta=25℃ )

| ITEM | | SYMBOL | MIN. | TYP. | MAX. | UNIT | Note |
|---|---|---|---|---|---|---|---|
| Lamp Voltage (IL=6mA) | | $V_L$ | - | 610 | 671 | Vrms | |
| Lamp Current | | $I_L$ | - | 6.0 | 8.0 | mA | |
| Inverter Frequency | | $F_L$ | 40 | - | 80 | kHz | *1) |
| Lamp life time *1) | | Life L | 30000 | - | - | hr | *2) |
| Starting Lamp Voltage | Ta=0℃ | Vs | - | - | 1130 | V | *3) |
| | Ta=25℃ | | - | - | 845 | | |

*1) The time that module luminance reduced to 50% of initial value, Base on Ta=25℃, I$_L$=6mA continuous.

*2)"Life time" is defined as the lamp brightness decrease to 50% original brightness at I$_L$ =6.0mA, continuous lighting, Ta=25℃.

*3) For starting the backlight unit,the output voltage of DC/AC's transformer should be larger than the maximum lamp starting voltage.

*4) If the driving waveform of Lamp is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Ar gas in it. Then it may cause the abnormal phenomenon of lighting- up. Therefore, designers have to try their best to for fill the conditions under the inverter designing-stage as

below :

・The degrees of unbalance： ＜10%
・The ratio of wave height： ＜√ 2 ±10%
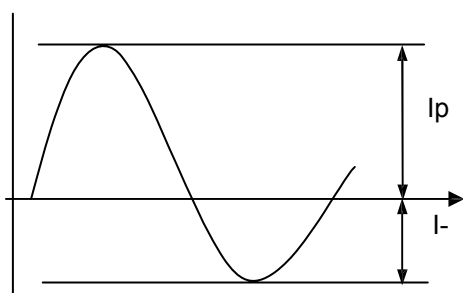


Ip：high side peak

I-p：low side peak

A：The degrees of unbalance = ∣Ip — I-p∣ / Irms ×100 (%)
B：The ratio of wave height = Ip (or I-p) / Irms

*5) Frequency in this range can make the characterisitics of electric and optics maintain in +/- 10% except hue.Lamp frequency of inverter may produce interference with horizontal synchronous frequency,and this may cause horizontal beat on the display.Therefore, please adjust lamp frequency, and keep inverter as far

from module as possible or use electronic shielding between inverter and module to avoid the interference.

## 3.4 Timing characteristics of input signals

| characteristics | SYMBOL | MIN. | TYP. | MAX. | UNIT | Note |
|---|---|---|---|---|---|---|
| 1 Field scanning period | T$_{IV}$ | - | 262.5 | - | H | |
| 1 Line scanning period | T$_{IH}$ | - | 63.5 | - | µs | |
| Source driver operating frequency | F$_{OP}$ | - | 9.6 | - | MHz | |
| CLK pulse width | T$_{CW}$ | 50 | 103.8 | 2000 | ns | |
| CLK pulse period duty | T$_{CWH}$ | 40 | - | 60 | % | |
| CLK pulse delay | TC12 TC23 TC31 | 12 | 69 | 1/2*T$_{CW}$ | ns | CPH1~CPH3 |
| STH start pulse width | T$_{STH}$ | 32 | 114.2 | - | ns | STHR,STHL |
| STH start pulse setup time | T$_{SUH}$ | 16 | 76.8 | - | ns | STHR,STHL |
| STH start pulse hold time | T$_{HDH}$ | 16 | 37.6 | - | ns | STHR,STHL |
| OEH output enable pulse width | T$_{OEH}$ | 1T$_{CW}$ | 2.7 | - | µs | OEH |
| Sample and hold disable time OEH& STH | T$_{OEH-STH}$ | 1 | 8.9 | - | µs | OEH-STH |
| CLKV pulse width | T$_{CKVW}$ | 1 | 63.5 | - | µs | CKV |
| CLKV pulse high period | T$_{CKVH}$ | 0.5 | 2.64 | - | µs | CKV |
| CLKV pulse low period | T$_{CKVL}$ | 0.5 | 60.9 | - | µs | CKV |
| STV start pulse width | T$_{STV}$ | 0.5 | 63.5 | - | µs | STVR, STVL |
| STV start pulse setup time | T$_{SUV}$ | 0.2 | 60.8 | - | µs | STVR, STVL |
| STV start pulse hold time | T$_{HDV}$ | 0.3 | 2.72 | - | µs | STVR,STVL |

| | | | | | | |
|---|---|---|---|---|---|---|
| OEV pulse width | $t_{OEV}$ | 1 | 5.3 | - | μs | OEV |
| Clean enable time | $t_{DIS2}$ | - | 2.54 | - | μs | OEV-CKV |

Note1：  1. High level of source driver and gate driver logic signal are 70%
2. Low level of source driver and gate driver logic signal are 30%
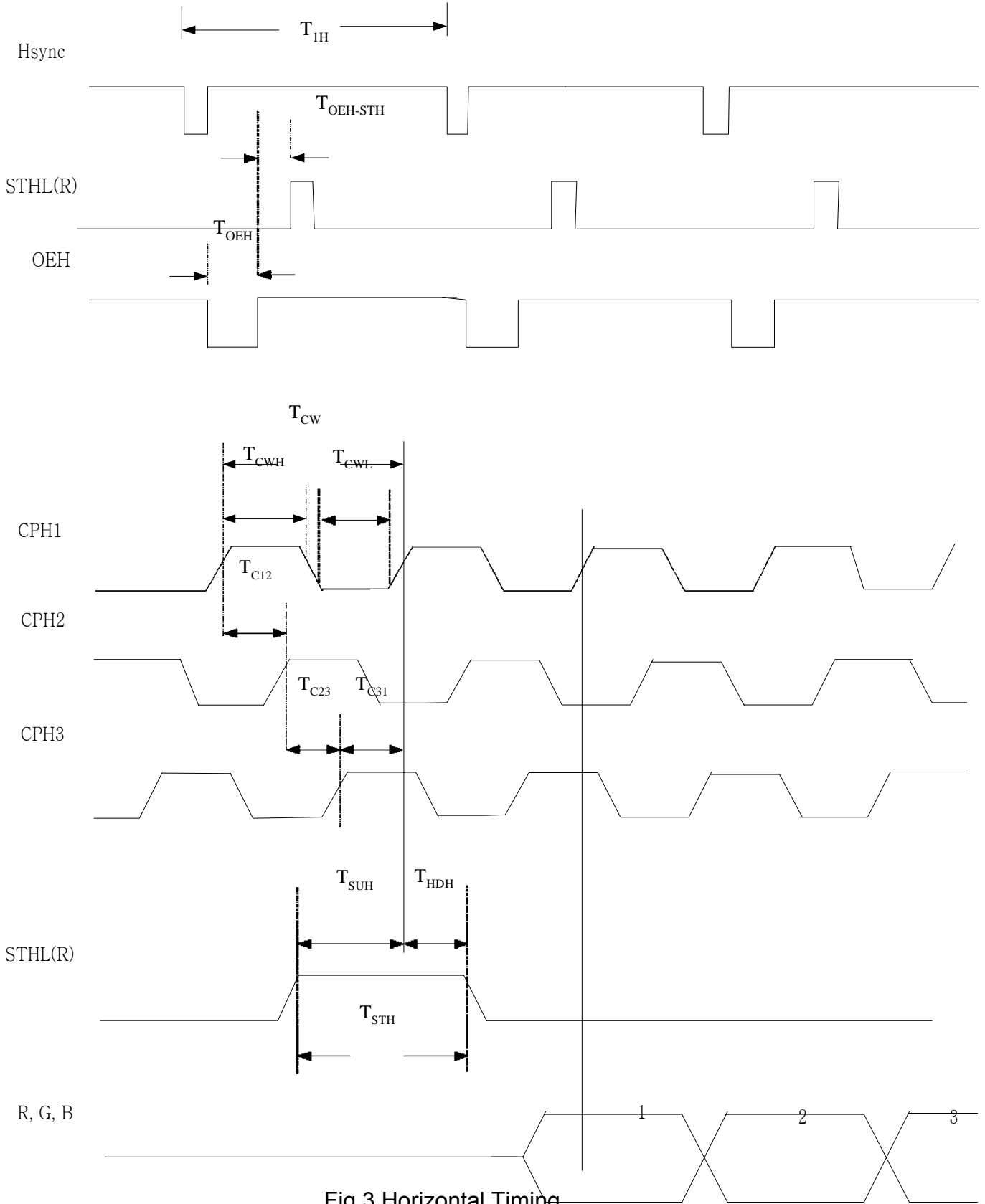
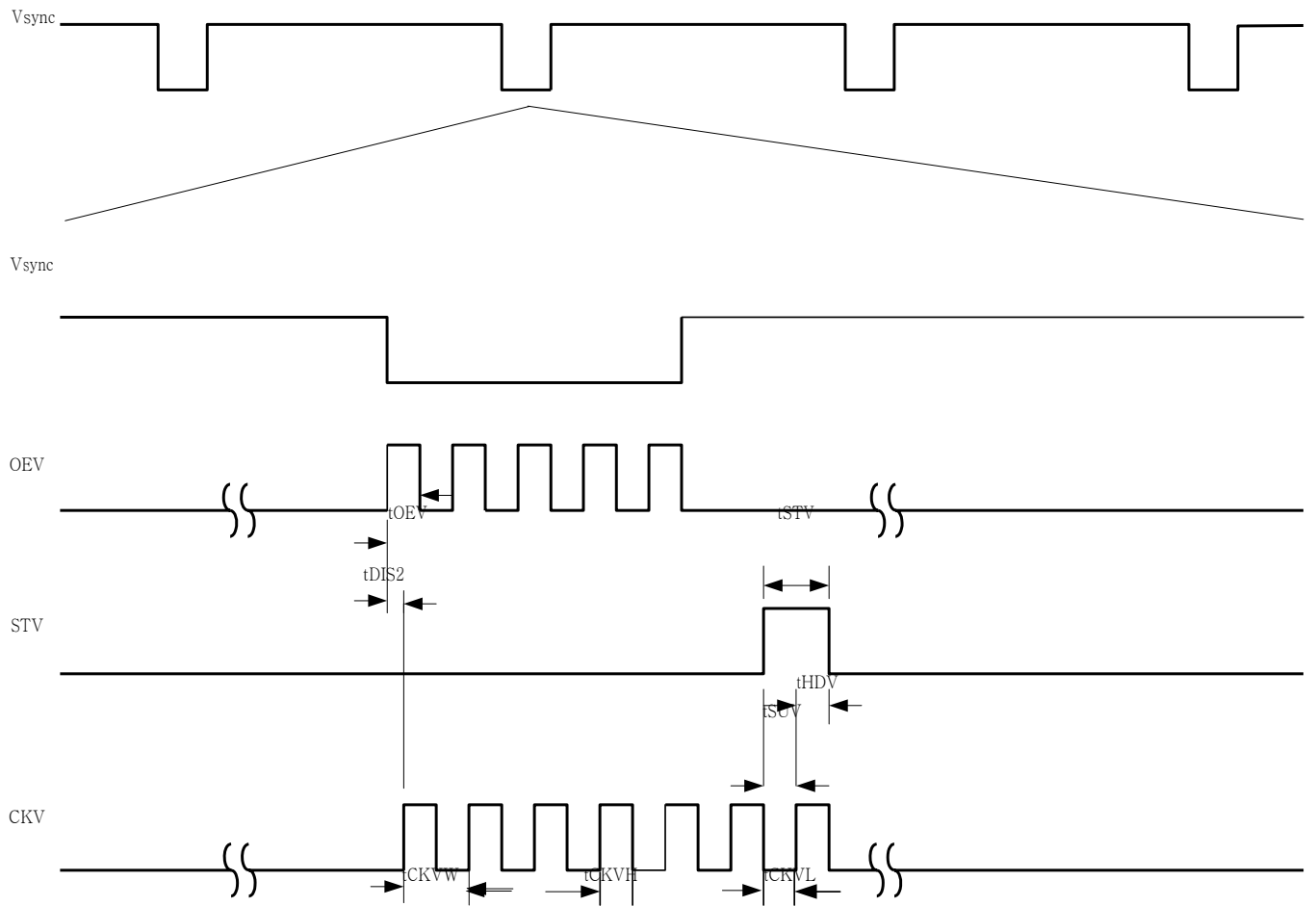Note2：Please refer to Fig.3 and Fig.4



Fig.3 Horizontal Timing

Fig.4 Vertical Timing sequence

# 4. INTERFACE CONNECTION:

4.1 CN1(Signal of interface)

Note1：

| Setting of scan control input | | IN/OUT state 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 |

| Pin No. | SYMBOL | I/O | FUNCTION | NOTE |
|---|---|---|---|---|
| 1 | GND | - | Ground for logic circuit | |
| 2 | Vcc | │ | Supply voltage of logic control circuit for scan driver | |
| 3 | VGL | │ | Negative power for scan driver | |
| 4 | VGH | │ | Positive power for scan driver | |
| 5 | STVR | I/O | Vertical start pulse | Note 1 |
| 6 | STVL | I/O | Vertical start pulse | Note 1 |
| 7 | CKV | │ | Shift clock input for scan driver | |
| 8 | U/D | │ | UP/DOWN scan control input | Note 1 |
| 9 | OEV | │ | Output enable input for driver | |
| 10 | VCOM | │ | Common electrode driving signal | |
| 11 | VCOM | │ | Common electrode driving signal | |
| 12 | L/R | │ | LEFT/RIGHT scan control input | Note 1 |
| 13 | MOD | │ | Sequential sampling and simultaneous sampling setting | Note 2 |
| 14 | OEH | │ | Output enable input for data driver | |
| 15 | STHL | I/O | Start pulse for horizontal scan line | Note 1 |
| 16 | STHR | I/O | Start pulse for horizontal scan line | Note 1 |
| 17 | CPH3 | │ | Sampling and shifting clock pulse3 for data drive | |
| 18 | CPH2 | │ | Sampling and shifting clock pulse2for data drive | |
| 19 | CPH1 | │ | Sampling and shifting clock pulse1 for data drive | |
| 20 | Vcc | │ | Supply voltage of logic control circuit for data driver | |
| 21 | GND | - | Ground for logic circuit | |
| 22 | VR | │ | Alternated video signal input(Red) | |
| 23 | VG | │ | Alternated video signal input(Green) | |
| 24 | VB | │ | Alternated video signal input(Blue) | |
| 25 | AVDD | │ | Supply voltage for analog circuit | |
| 26 | AVSS | - | Ground for analog circuit | |

Note2： MOD=H: Simultaneous sampling (Set CPH2 and CPH3 to LOW)
   MOD=L: Sequential sampling

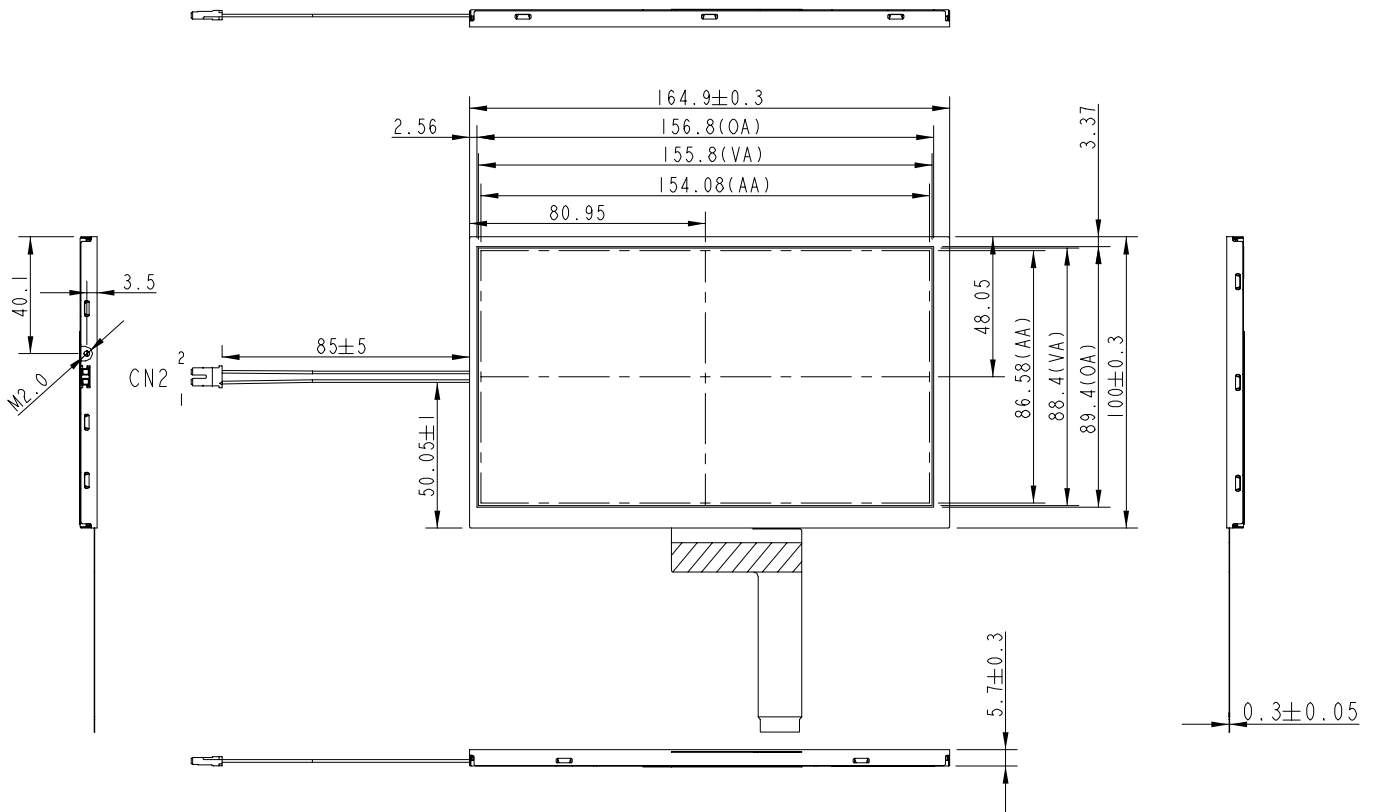4.2 CN2 (backlight )
Backlight-side connector: BHSR-02VS-1 (JST made)
Inverter-side connector: SM02B-BHSS-1 (JST made)

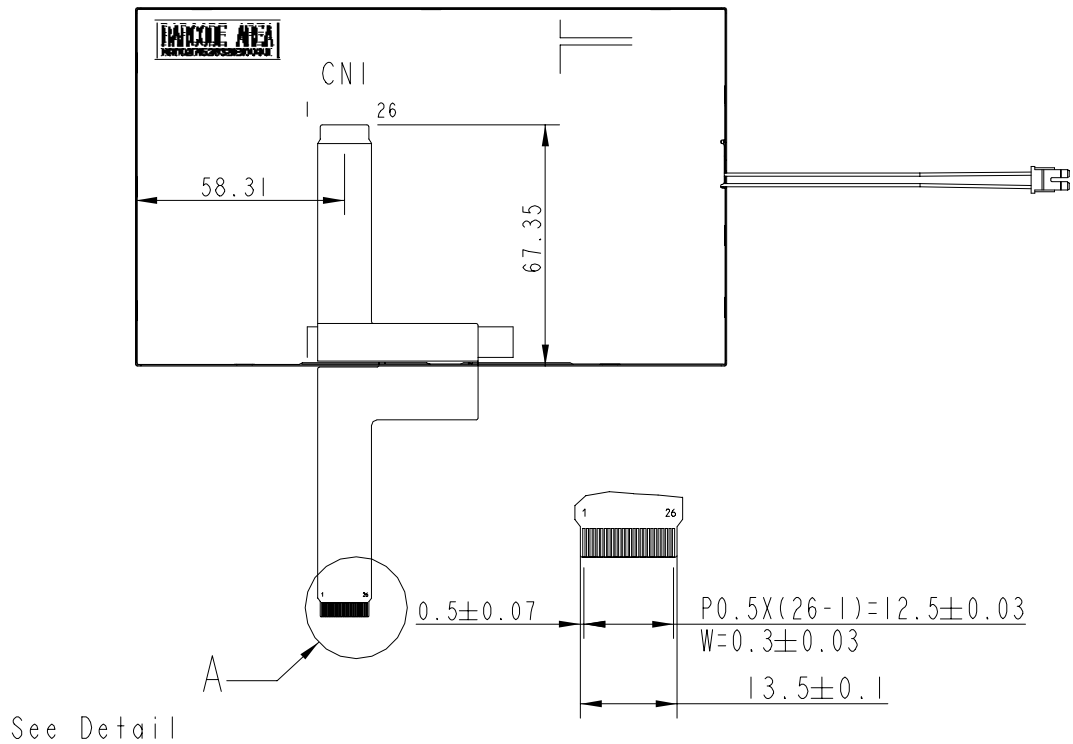| Pin No. | SYMBOL | FUNCTION |
|---|---|---|
| 1 | CTH | VBLH (high Voltage) |
| 2 | CTL | VBLL (low Voltage) |

[Note]： VBLH-VBLL=VL

# 5. MECHANICAL DIMENSION

(1) Front Side



(2) Rear Side



[Note]：(Tolerance is ±0.5mm unless noted)

Detail A
Scale 1:1

[Unit： mm]

# 6. OPTICAL CHARACTERISTICS

Ta=25℃, VCC=3.3V

| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | *1) | (350) | 400 | -- | -- |
| Luminance | | L | *3) $I_L$ = 6.0mA | 280 | 350 | -- | cd/m$^2$ |
| Luminance Uniformity | | ⊗ | *4) | 80 | -- | -- | % |
| Response Time | Tr | | *5) | -- | 20 | 40 | ms |
| | Tf | | | -- | | | ms |
| Viewing Angle | Horizontal | φ$^{*2)}$ | CR≧10 | 110 | 120 | -- | ° |
| | Vertical | θ$^{*2)}$ | | 90 | 100 | -- | ° |
| Color Coordinate | Red | x | θ=φ=0° | TBD | TBD | TBD | -- |
| | | y | | | | | |
| | Green | x | | TBD | TBD | TBD | |
| | | y | | | | | |
| | Blue | x | | TBD | TBD) | TBD | |
| | | y | | | | | |
| | White | x | | (0.270) | (0.300) | (0.330) | |
| | | y | | (0.280) | (0.310) | (0.340) | |
| | NTSC | | | 45 | 50 | -- | % |

[Note]
⌘ These items are measured by BM-5A (TOPCON) or CA-1000(MINOLTA) in the dark room. (no ambient light).

⌘ Measurement Condition: IL=6.0 mA, Inverter：HIU-766(52K) (Harison made)
Measuring point：Fig.5 Measuring point：1~9 points
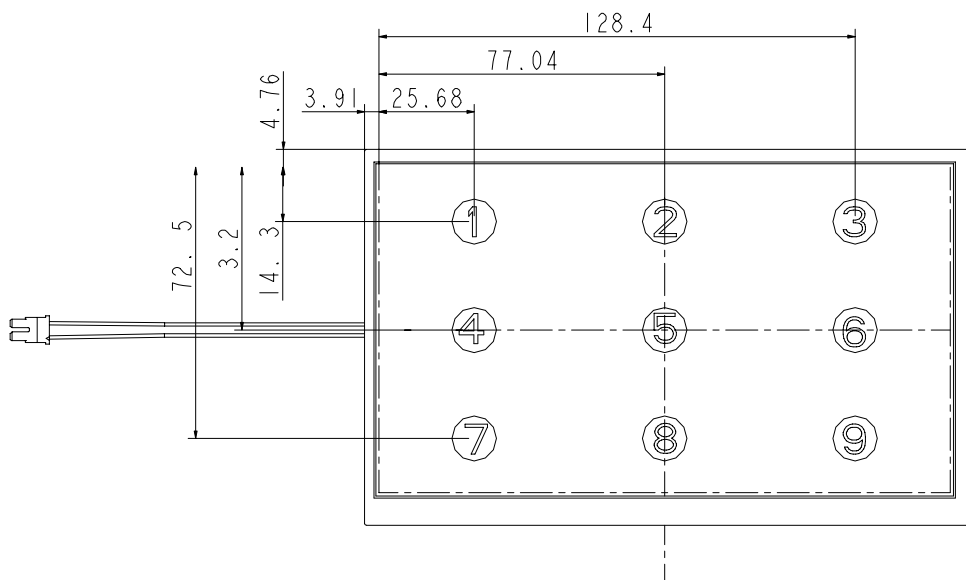Measuring Viewing Angle：Fig.6：θ=ψ=0°



Fig.5 Measuring point

*1) Definition of contrast ratio：
Measure contrast ratio on the 5 points (refer to figure5, #1~#9 point)
Contrast ratio is calculated with the following formula ：
Contrast Ratio (CR) = (White) Luminance of ON ÷ (Black) Luminance of OFF
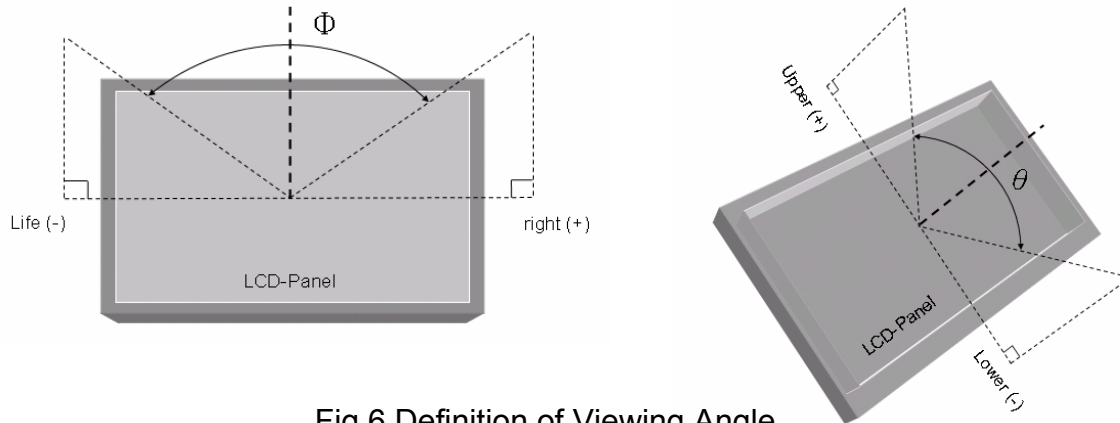
*2) Definition of Viewing Angle(θ,ψ)：



Fig.6 Definition of Viewing Angle

*3) Definition of luminance：
  Measure white luminance on the 5 points as figure 5 and take the average value.

*4) Definition of Luminance Uniformity：
  Measure maximum luminance(L(MAX) )and minimum luminance (L(MIN) )on the 5
  points as figure 4.Luminance Uniformity is calculated with the following formula ：
          $\triangle L = L(MIN) / L(MAX)×100\%$

*5) Definition of Response Time
  The response time is defined as the time interval between the 10% and 90%
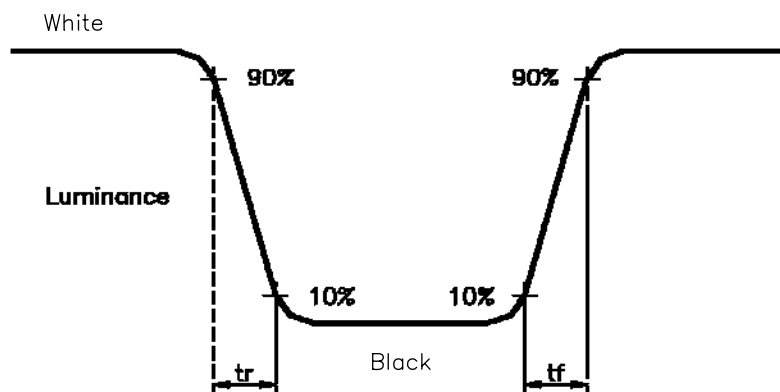  amplitudes.Refer to figure 7 as below.



Fig.7 Definition of Response Time

# 7. RELIABILITY TEST CONDITIONS

## (1) Temperature and Humidity

| TEST ITEMS | CONDITIONS |
|---|---|
| HIGH TEMPERATURE OPERATION | 85°℃ ；240 Hrs |
| HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION | 60°℃ ；90％ RH ；240 Hrs |
| HIGH TEMPERATURE STORAGE | 95°℃ ；240 Hrs |
| LOW TEMPERATURE OPERATION | -30°℃ ；240Hrs (Backlight unit always turn on) |
| LOW TEMPERATURE STORAGE | -40°℃ ；240 Hrs |
| THERMAL SHOCK (No operation) | -30°℃ (0.5Hr) ~ 85°℃ (0.5Hr) 200 CYCLE |

## (2) Shock & Vibration

| TEST ITEMS | CONDITIONS |
|---|---|
| SHOCK (NON-OPERATION) | ⌘ Shock level: 980m/s$^2$(equal to 100G).<br>⌘ Waveform: half sinusoidal wave,6ms.<br>⌘ Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of three shock inputs. |
| VIBRATION (NON-OPERATION) | ⌘ Frequency range:8~33.3Hz<br>⌘ Stoke：1.3 mm<br>⌘ Vibration: sinusoidal wave, perpendicular axis (both x,z axis: 2Hrs , and y axis: 4Hrs ).<br>⌘ Sweep: 2.9G,33.3 Hz -400 Hz<br>⌘ Cycle: 15 min |

## (3) Judgment standard

The judgment of the above test should be made as follow：
Pass:  Normal display image with no obvious non-uniformity and no line defect.
Partial transformation of the module parts should be ignored.
Fail:  No display image, obvious non-uniformity, or line defects.