# Chunghwa Picture Tubes, Ltd.
# Product Specification

**To : SCL**
**Date : 2010/03/04**

***TFT LCD***
## CLAA133WA01

**Accepted by:**

| APPROVED BY | CHECKED BY | PREPARED BY |
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# REVISION STATUS

| Revision Notice | Description | Page | Rev. Date |
|---|---|---|---|
| T1 | Tentative revision | - | 2009/06/13 |
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# 1. OVERVIEW

**CLAA133WA01** is 13.3" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and LED backlight. By applying 6 bit digital data, 1366×RGB(3)x768, 262K colors aredisplayed on the 13.3" diagonal screen.

General specification are summarized in the following table:

| ITEM | SPECIFICATION |
|---|---|
| Display Area (mm) | 293.417(H) x 164.966(V) (13.3-inch diagonal) |
| Number of Pixels | 1366(H) × 3(RGB) × 768(V) |
| Pixel Pitch (mm) | 0.2148 (H) × 0.2148 (V) |
| Color Pixel Arrangement | RGB vertical stripe |
| Display Mode | Normally white |
| Number of Colors | 262,144 |
| Gamut | 42% (min) / 45% (typ) |
| Optimum Viewing Angle | 6 o'clock |
| Response Time (Tr+Tf) | 8ms (typ) |
| Surface Treatment | Anti-Glare |
| Viewing Angle(BL on,CR≧10) | 40/40/15/30 degree (min) |
| Brightness (cd/m^2) | 200nit (typ) / 16mA |
| Uniformity | 5point：80 %(Min)<br>13point：65 %(Min) |
| Power Consumption | 3.6 W (max) |
| Module Size (mm) | 314.6(W)×189.25(H)×3.6(D)（Max） |
| Module Weight (g) | 290(max) |

The LCD Products listed on this document are not suitable for use of aerospace equipment, submarine cable, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for applications listed above or those not included in the "Standard" list as follows, please contact our sales in advance.

Standard ： Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tool, Industrial robot, Audio and Visual equipment, Other consumer products.

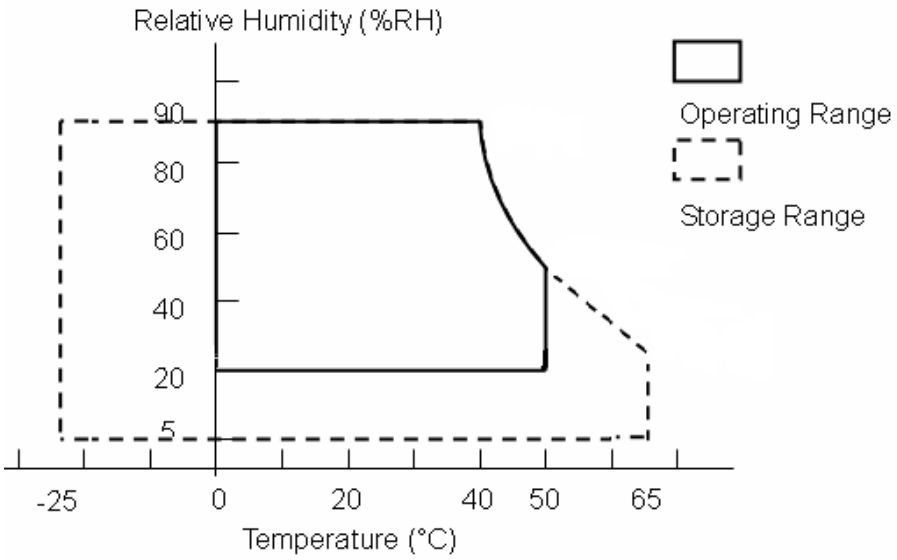
## 2. ABSOLUTE MAXIMUM RATINGS

The following are maximun values, which if exceeded, may cause faulty operation or damage to the unit.

| ITEM | SYMBOL | MIN. | MAX. | UNIT | REMARK |
|---|---|---|---|---|---|
| Power Supply Voltage for LCD | VCC | 0 | 4.0 | V | |
| LED Driver Input Voltage | VBL+ | 0 | 22 | V | |
| LED Driver Input Current | IBL+ | - | 650 | mA | *8) |
| PWM Frequency | PWM_BL | 180 | 1000 | MHz | *7) |
| Duty ratio | Dim | 10 | 100 | % | |
| LED Forward Current | $I_F$ | - | 25 | mA | *1).2) |
| Operation Temperature | Top | 0 | 50 | ℃ | *3). 4). 5). 6) |
| Storage Temperature | Tstg | -25 | 65 | ℃ | *3). 4). 5) |

【Note】

*1) Product life-time relate to LED current, please operate production follow statement at page 9 〝(B)Backlight”.
*2) When LED current over the definition of absolute max, product life-time will decay rapidly or operate unusual.
*3) The relative temperature and humidity range are as below sketch, 90%RH Max. (Ta≦40℃)
*4) The maximum wet bulb temperature ≦39℃(Ta＞40℃) and without dewing.
*5) If product in environment which over the definition of the relative temperature and humidity out of range too long, it will affect visual of LCD.
*6) If you operate LCD in normal temperature range, the center surface of panel should be under 50℃.
*7) The suggested external PWM frequency’s typical value is 200Hz.
*8) Maximum LED Driver Input Current at 7V Input Voltage.



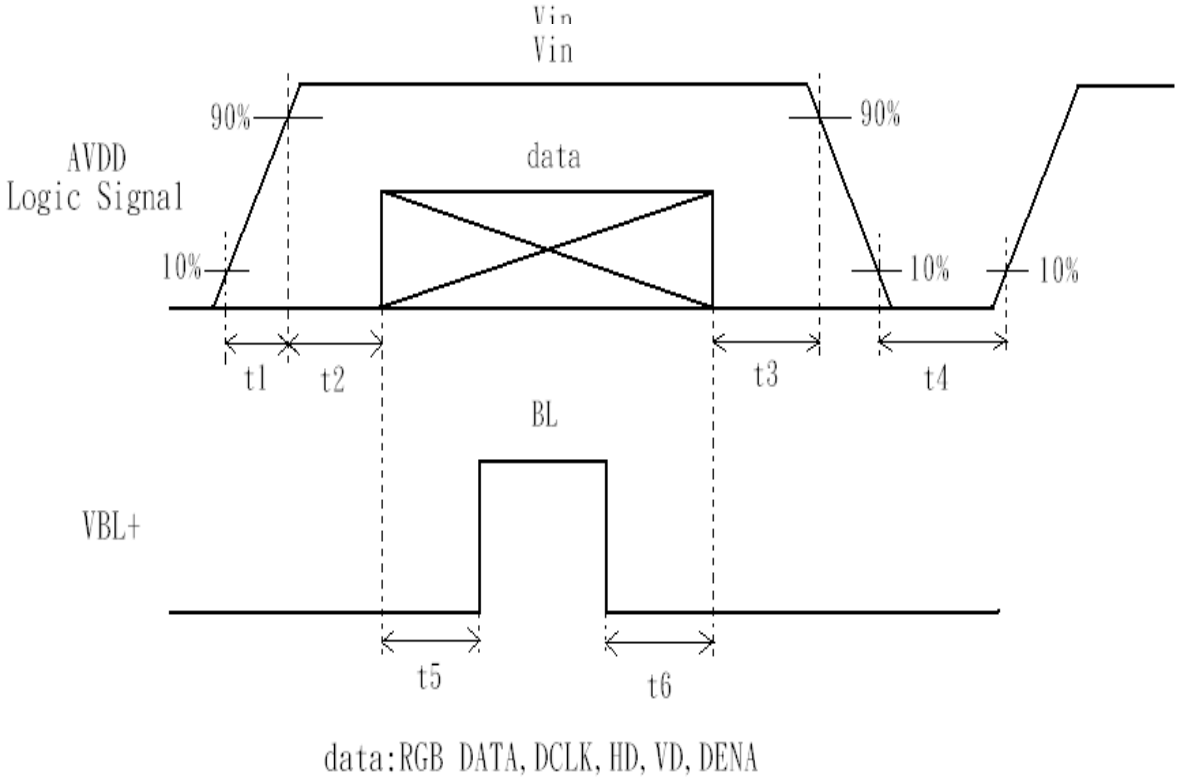
# 3. ELECTRICAL CHARACTERISTICS

## (A)TFT LCD Power Voltage

| TEM | | SYMBOL | MIN | TYP | MAX | UNIT | REMARK |
|---|---|---|---|---|---|---|---|
| LCD POWER VOLTAGE | | VCC | 3.0 | 3.3 | 3.6 | V | 【Note 1】 |
| LCD POWER CURRENT | | ICC | - | 260 | 300 | mA | 【Note 2】 |
| Rush CRRENT | | Irush | - | - | 2 | A | 【Note 4】 |
| LOGIC INPUT VOLTAGE (LVDS: IN+,IN-) | INPUT VOLTAGE | VIN | 0 | - | VCC | V | 【Note 3】 |
| | COMMON VOLTAGE | VCM | 1.125 | 1.25 | 1.375 | V | 【Note 3】 |
| | DIFFRENTIAL INPUT VOLTAGE | \| VID \| | 250 | 350 | 450 | mV | 【Note 3】 |
| | THRESHOLD VOLTAGE (HIGH) | VTH | - | - | 100 | mV | 【Note 3】 When VCM = +1.2V |
| | THRESHOLD VOLTAGE (LOW) | VTL | -100 | - | - | mV | |

【Note 1】Power Sequence：

0.5 ms ≦t1≦10ms　　500ms≦t4
0.01 ms＜t2≦50 ms　　200 ms≦t5
0.01 ms＜t3≦50 ms　　200 ms≦t6

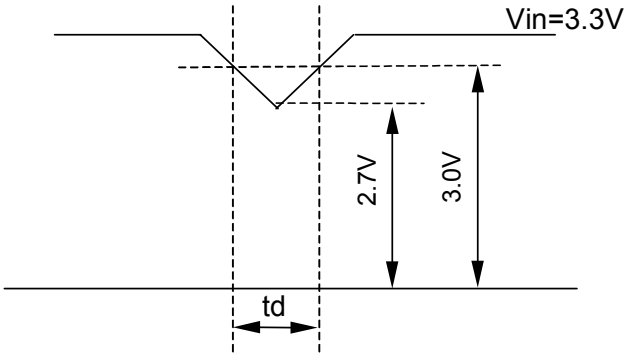



data:RGB DATA, DCLK, HD, VD, DENA

VCC-dip state

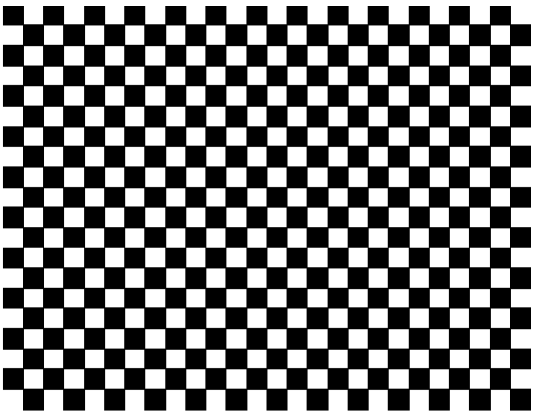
(1)when 3.0＞VCC≧2.7V & td≦10 ms module works well.

(2)when VCC＜2.7V，VCC-dip condition should be the same as the VCC-turn-off condition.




【Note 2】Typical value is Mosaic (32*36 Checker board) Pattern：768 line mode。

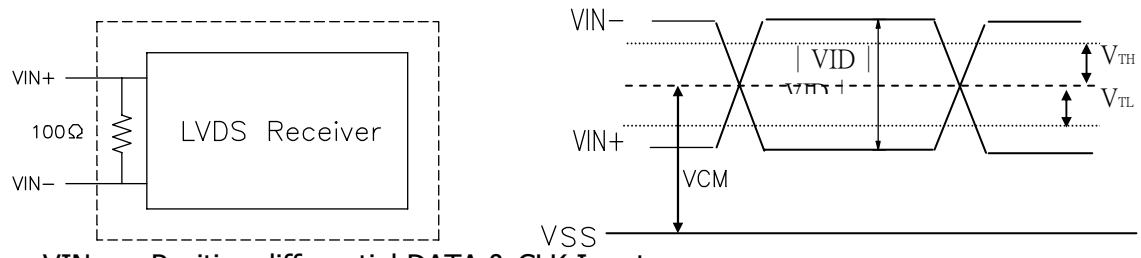
Circuit condition (typ)：VCC=3.3 V，fV=60 Hz fH=48.36 kHz，fCLK=75.44 MHz



Max value is Black Pattern：768 line mode。

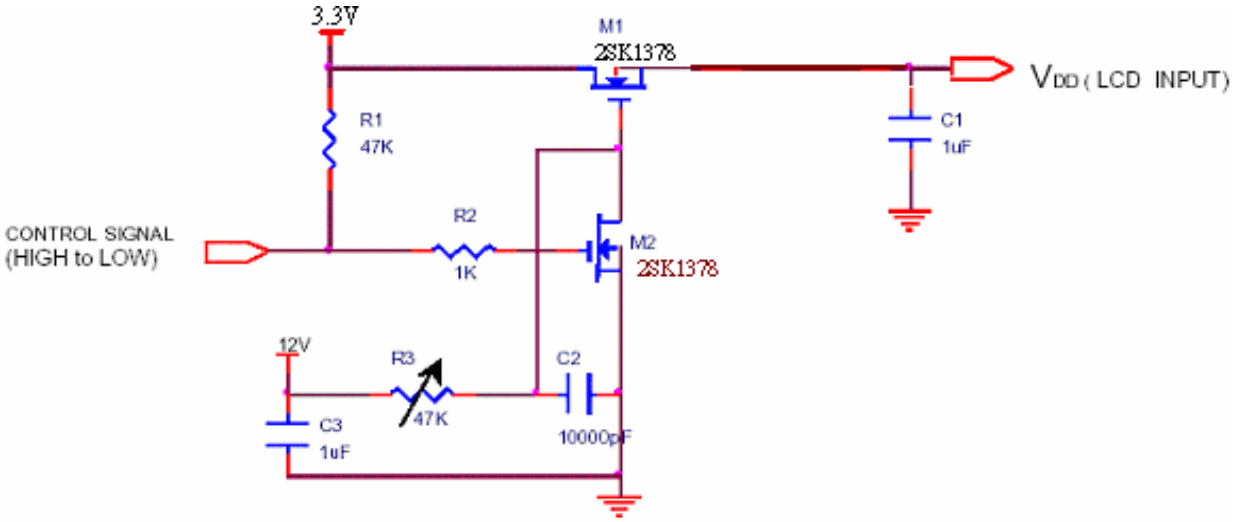
Circuit condition (max)：VCC=3.3 V，fV=60 Hz fH=48.36 kHz，fCLK=75.44 MHz

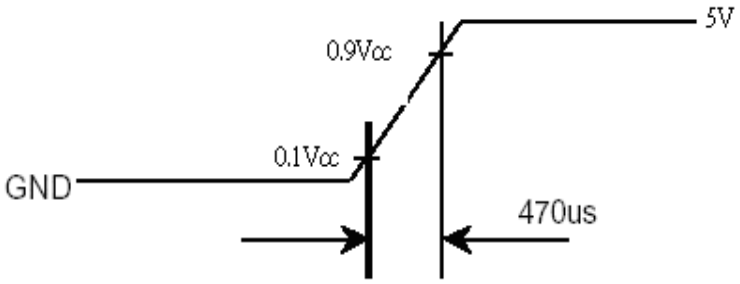
【Note 3】LVDS Signal Definite：




VIN+： Positive differential DATA & CLK Input
VIN-： Negative differential DATA & CLK Input

【Note 4】Irush measure condition



## (B) BACKLIGHT

(a) Electrical Characteristics

Ta=25℃

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|---|---|---|---|---|---|---|
| Forward Voltage | VF | 2.9 | 3.2 | 3.5 | V | |
| Forward Current | IF | 15.5 | 16 | 16.5 | mA | |
| BL Power consumption | W | 2.18 | 2.41 | 2.64 | W | *1) IF=16mA |

**Note:BL power consumption P =n × ($V_F$ × $I_F$)÷driver efficiency**
**n: number of LED**

(b) LED Life Time

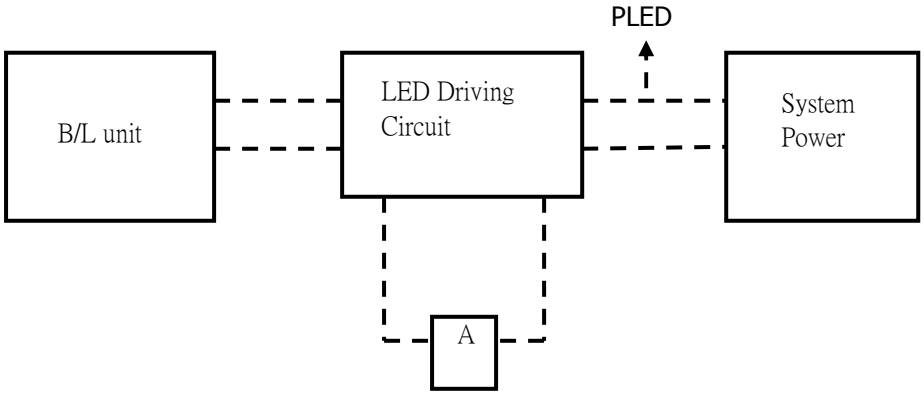
| ITEM | Condition | min | typ | max | UNIT | NOTE |
|---|---|---|---|---|---|---|
| LIFE TIME | $I_F$=20mA、Ta=25℃ | 15000 | - | - | hrs | *2) |

【Note】

*1) Measure method：

a. LED current is measured by utilizing a current meter as show below.

b. We set up system power input voltage at 12V to measurement PLED.




*2) Lifetime means that estimated time to 50% degradation of initial luminous intensity.

# 4. CONNECTOR INTERFACE PIN & FUNCTION

### CN (Interface signal)

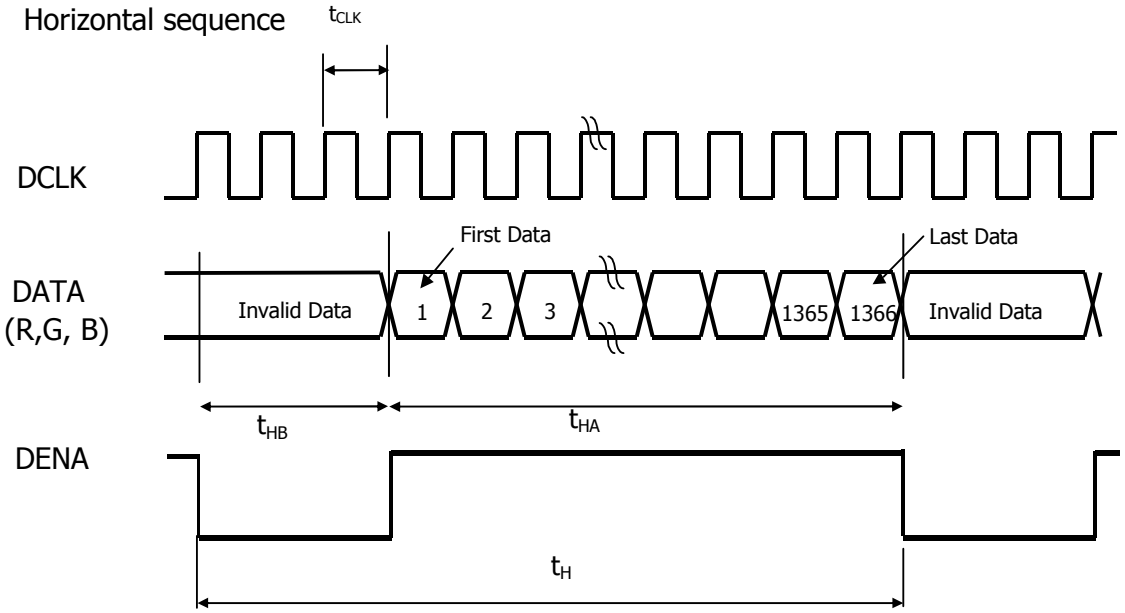
Outlet connector: I-PEX 20455-040E-12

| Pin No. | SYMBOL | FUNCTION |
|---|---|---|
| 1 | DIAG_LOOP | Diag pin for Dell testing. Pin 1 & 34 must be connected together on the inverter board |
| 2 | VDD | Power Supply, 3.3 V (typical) |
| 3 | VDD | Power Supply, 3.3 V (typical) |
| 4 | V EEDID | DDC 3.3V power |
| 5 | NC | No connection |
| 6 | Clk EEDID | DDC Clock |
| 7 | DATA EEDID | DDC Data |
| 8 | Odd_Rin0- | - LVDS differential data input (R0-R5, G0) (odd pixels) |
| 9 | Odd_Rin0+ | + LVDS differential data input (R0-R5, G0) (odd pixels) |
| 10 | VSS | Ground – Shield |
| 11 | Odd_Rin1- | - LVDS differential data input (G1-G5, B0-B1) (odd pixels) |
| 12 | Odd_Rin1+ | + LVDS differential data input (G1-G5, B0-B1) (odd pixels) |
| 13 | VSS | Ground – Shield |
| 14 | Odd_Rin2- | - LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels) |
| 15 | Odd_Rin2+ | + LVDS differential data input (B2-B5, HS, VS, DE) (odd pixels) |
| 16 | VSS | Ground – Shield |
| 17 | Odd_ClkIN- | - LVDS differential clock input (odd pixels) |
| 18 | Odd_ClkIN+ | + LVDS differential clock input (odd pixels) |
| 19 | VSS | Ground – Shield |
| 20 | NC | No connection |
| 21 | NC | No connection |
| 22 | VSS | Ground – Shield |
| 23 | NC | No connection |
| 24 | NC | No connection |
| 25 | VSS | Ground – Shield |
| 26 | NC | No connection |
| 27 | NC | No connection |
| 28 | VSS | Ground – Shield |
| 29 | NC | No connection |
| 30 | NC | No connection |
| 31 | VSSLED | Ground – LED |
| 32 | VSSLED | Ground – LED |
| 33 | VSSLED | Ground – LED |
| 34 | DIAG_LOOP | Diag pin for Dell testing. Pin 1 & 34 must be connected together on the inverter board |
| 35 | PWM | System PWM Signal Input (+3.3V Swing) |
| 36 | LED_EN | LED enable pin (+3.3V Input) |
| 37 | NC | NC |
| 38 | VDDLED | 7 V – 21V LED power |
| 39 | VDDLED | 7V – 21V LED power |
| 40 | VDDLED | 7V – 21V LED power |

# 5. INTERFACE TIMING CHART

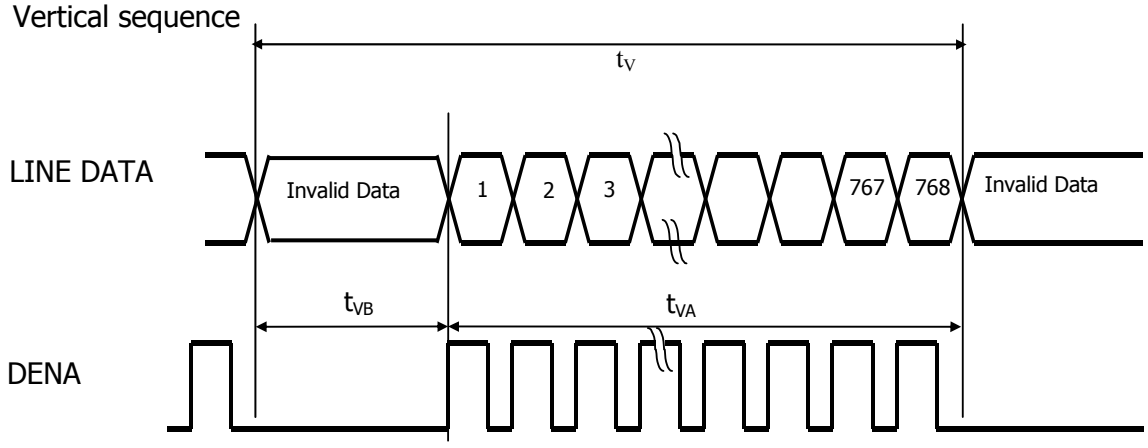
### (A)LVDS input time sequence

Horizontal sequence




### (B)LCD input time sequence

Vertical sequence




### (C) Timing Chart

| ITEM | | | | SYNBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| LCD Timing | Frame Rate | | | - | | 60 | | Hz |
| | DCLK | | Frequency | $f_{CLK}$ | 65.83 | 75.44 | 88.74 | MHz |
| | | | Period | $t_{CLK}$ | 11.26 | 13.25 | 15.19 | ns |
| | DENA | Horizontal | Horizontal total time | $t_H$ | 1414 | 1560 | 1700 | $t_{CLK}$ |
| | | | Horizontal Active time | $t_{HA}$ | 1366 | 1366 | 1366 | $t_{CLK}$ |
| | | | Horizontal Blank time | $t_{HB}$ | 48 | 194 | 334 | $t_{CLK}$ |
| | | Vertical | Vertical total time | $t_V$ | 776 | 806 | 870 | $t_H$ |
| | | | Vertical Active time | $t_{VA}$ | 768 | 768 | 768 | $t_H$ |
| | | | Vertical Blank time | $t_{VB}$ | 8 | 38 | 114 | $t_H$ |

【Note】

*1) DENA (DATA ENABLE) usually is positive.

*2) During the whole blank period, DCLK should keep input.

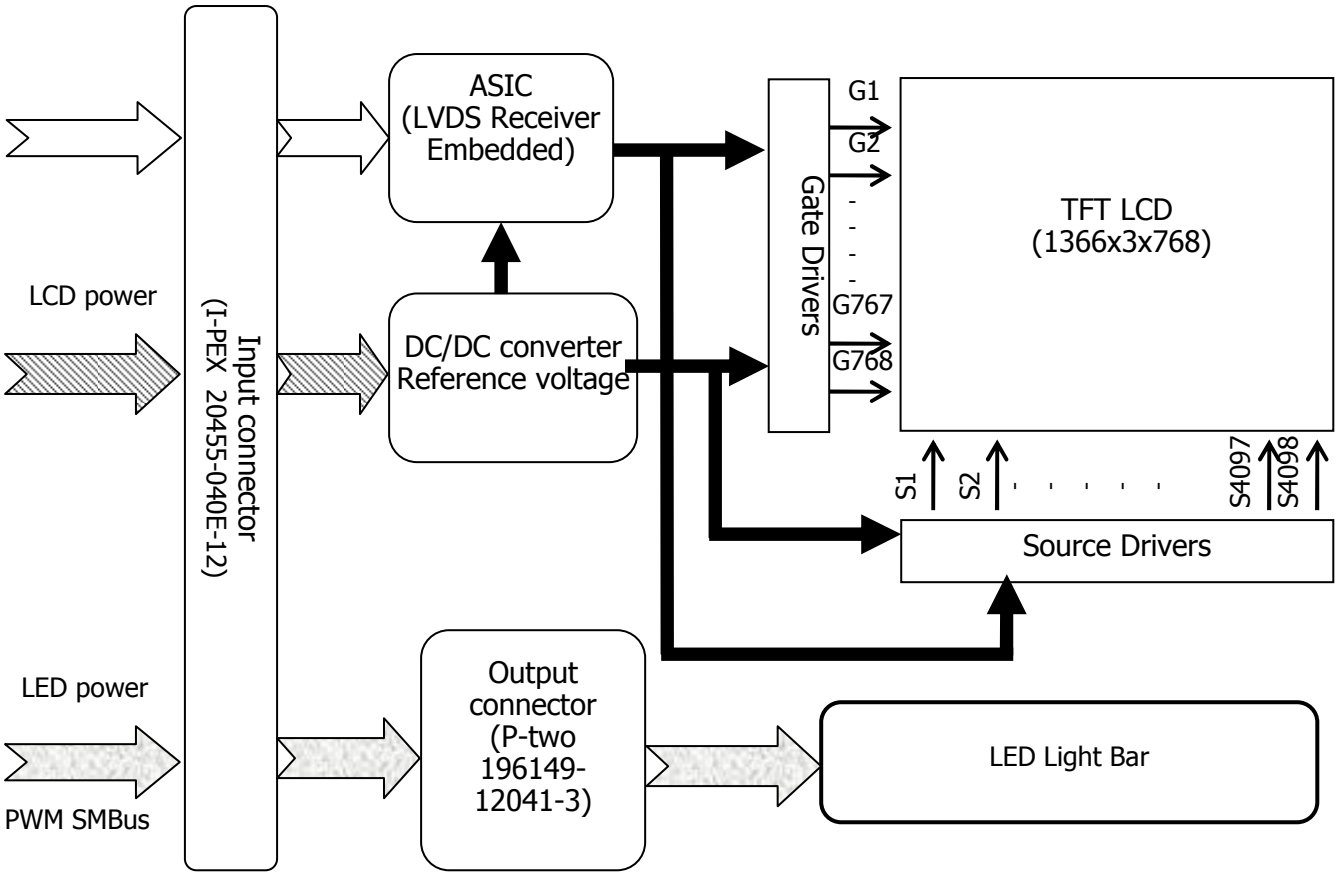
**(D) DATA mapping**

| Color | Input Data | R DATA | | | | | | G DATA | | | | | | B DATA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| | | MSB | | | | | LSB | MSB | | | | | LSB | MSB | | | | | LSB |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(63) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| RED | RED(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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(2) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | RED(62) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(63) | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(63) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| | Blue(1) | 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 | 1 | 0 |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(63) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

【Note】

1) Gray level :
   Color(n)：n is level order; higher n means brighter level.
2) DATA :
   1: high，0: low

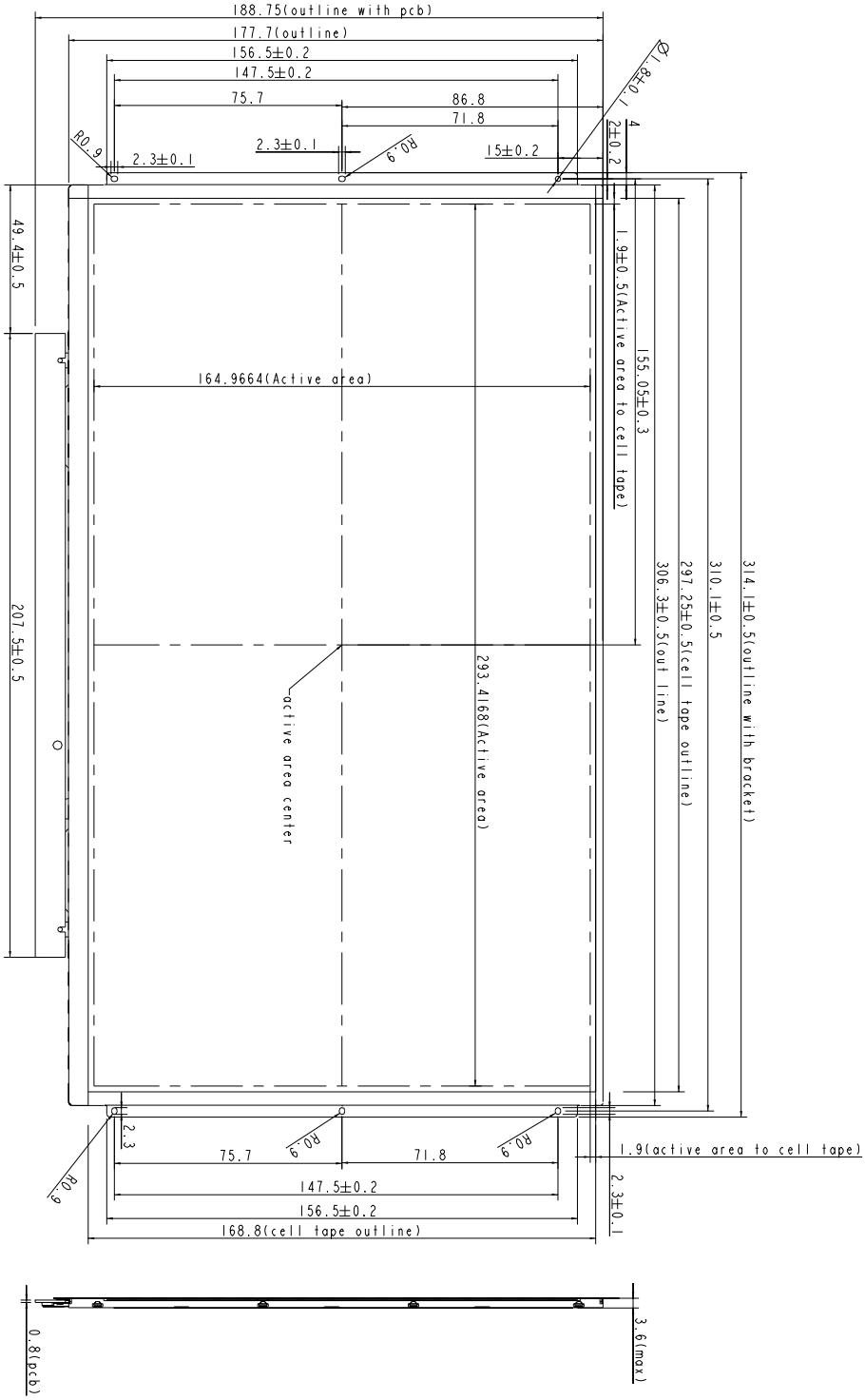
## 6. BLOCK DIAGRAM



# 7. MECHANICAL SPECIFICATION

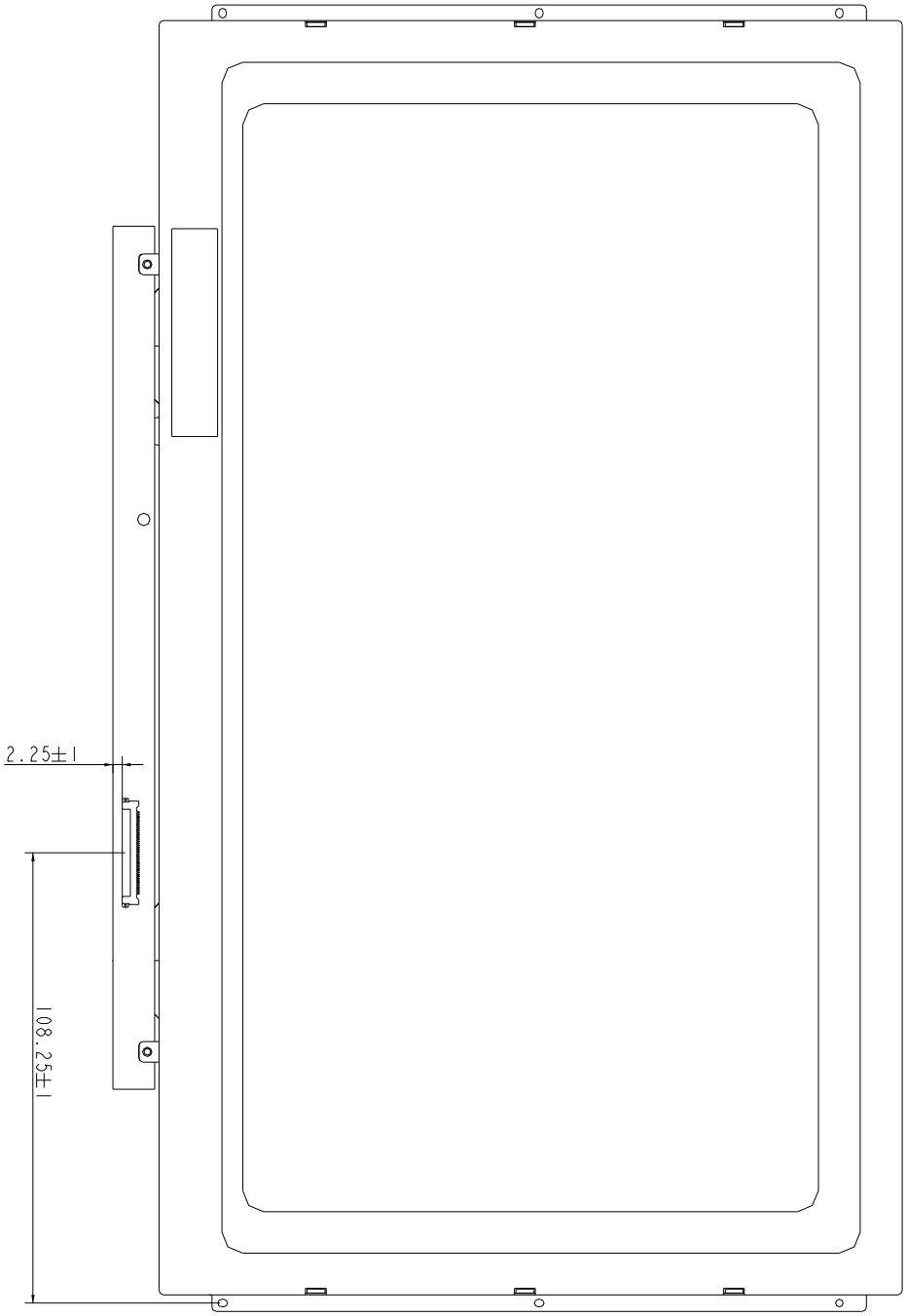
## (A)Front side

**The tolerance, not show in the figure, is ±0.5mm.** **[Unit： mm]**



**(B) Rear side**

**The tolerance, not show in the figure, is ±0.5mm.** **[Unit： mm]**



# 8. OPTICAL CHARACTERISTICS

Ta=25℃ , VDD=3.3V

| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | Point-7 | 500 | 600 | - | -- | *1) 2) |
| Luminance (5P) | | L | 5-Point Avg. | 180 | 200 | - | $cd/m^2$ | *1) 3) |
| Uniformity(5P) | | ΔL | θ = ψ= 0° | 80 | - | - | % | *1) 3) |
| Response Time | | Tr | θ = ψ= 0° | - | 8 | 16 | ms | *5) |
| Cross talk | | CT | θ = ψ= 0° | - | - | 1 | % | *6) |
| View angle | Horizontal | ψ | CR≧10 | 40/-40 | - | - | ° | *4) |
| | Vertical | θ | | 15/-30 | - | - | ° | *4) |
| Color Temperature Coordinate | W | X | θ = ψ= 0° | 0.293 | 0.313 | 0.333 | -- | *3) |
| | | Y | | 0.309 | 0.329 | 0.349 | | |
| | R | X | | 0.560 | 0.580 | 0.600 | -- | |
| | | Y | | 0.320 | 0.340 | 0.360 | | |
| | G | X | | 0.290 | 0.310 | 0.330 | -- | |
| | | Y | | 0.530 | 0.550 | 0.570 | | |
| | B | X | | 0.135 | 0.155 | 0.175 | -- | |
| | | Y | | 0.105 | 0.125 | 0.145 | | |
| Gamut | | | θ = ψ= 0° | 42% | 45% | - | -- | - |
| Gamma | | γ | GL | 2.0 | 2.2 | 2.4 | -- | *7) |

Color coordinate and color gamut are measured by SRUL1R, response time is measured by TRD-100,and all the other items are measured by BM-5A (TOPCON). All these items are measured under the dark room condition (no ambient light).
Measurement Condition: IL=16mA (each LED)

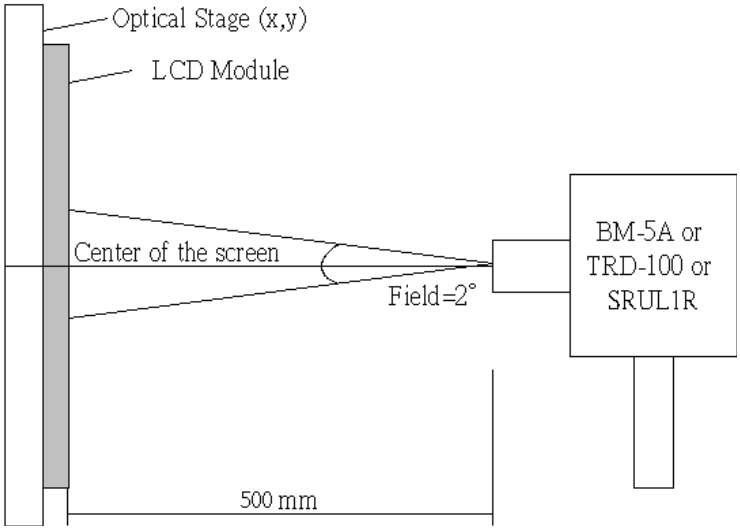
**Definition of these measurement items is as follows:**

***1) Setup of Measurement Equipment**

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.

***2) Definition of Contrast Ratio**

CR=ON (White) Luminance/OFF (Black) Luminance




***3) Definition of Luminance and Luminance uniformity**

Central luminance: The white luminance is measured at the center position "5" on the screen, see Fig.1 below.

5P Luminance (AVG): The white luminance is measured at measuring points 5、10、11、12、13, see Fig.1 below.

5P Uniformity: **Δ L = (Lmin / Lmax) ×100%**

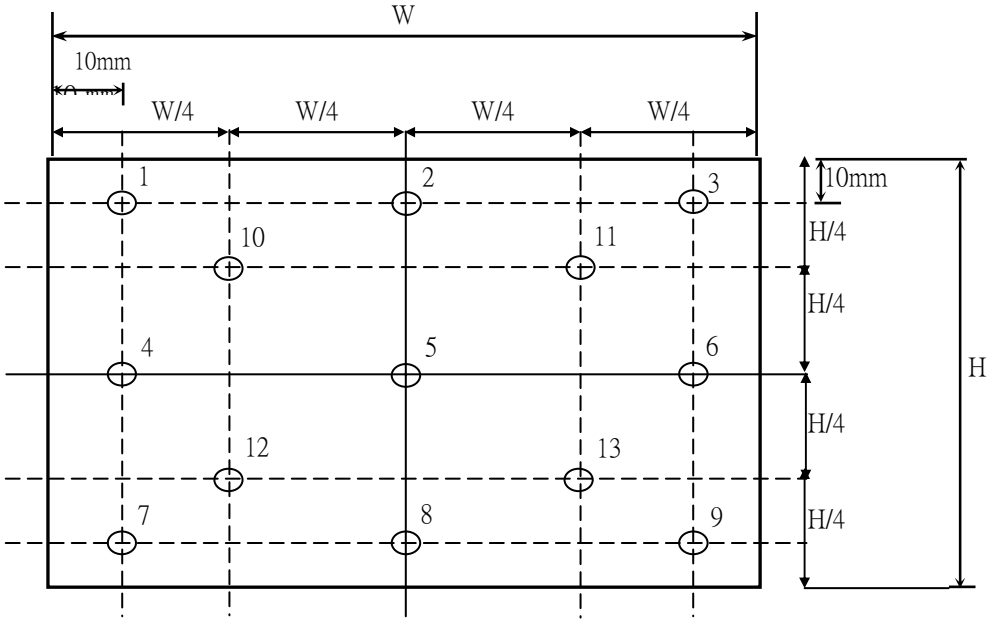
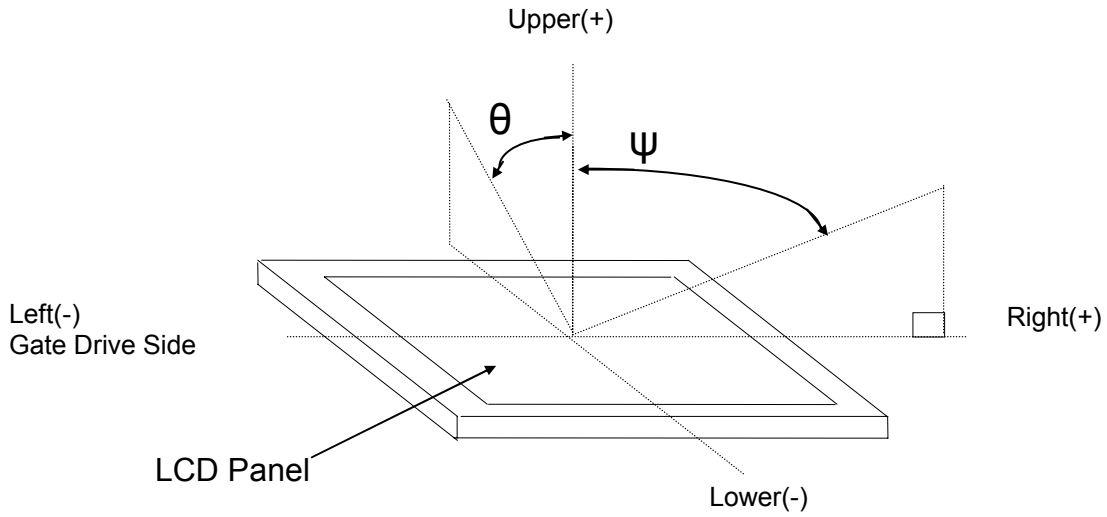
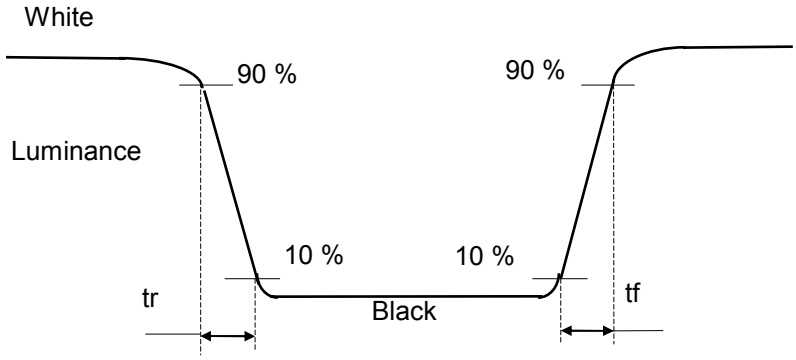



Fig.1 Measure point (Active area)

***4) Definition of view angle(θ，ψ)**




***5) Definition of response time**



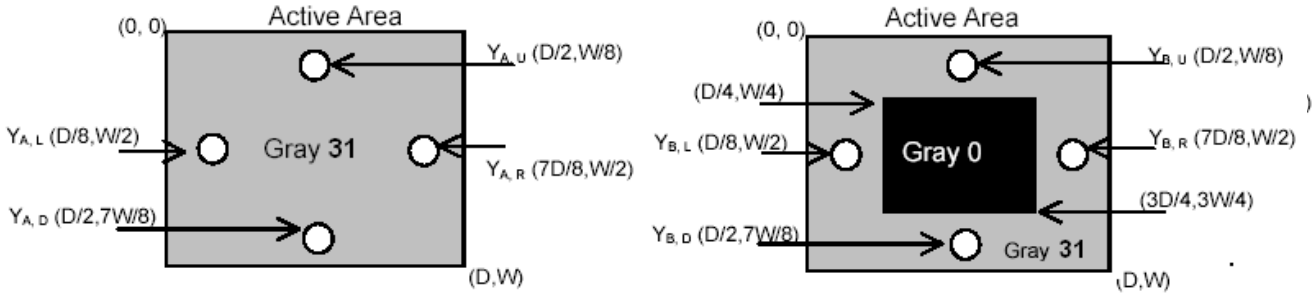

***6) Crosstalk Modulation Ratio:**

CT= | $Y_B$-$Y_A$ | / $Y_A$× 100%

$Y_A$ 、$Y_B$ measure position and definition

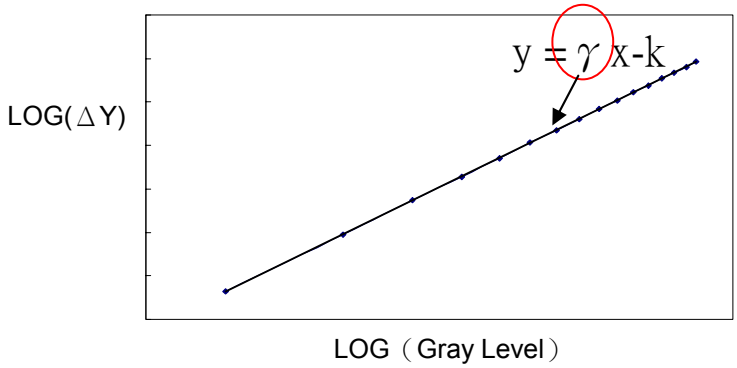
$Y_A$ means luminance at gray level 32(exclude gray level 0 pattern)

$Y_B$ means luminance at gray level 32(include gray level 0 pattern)



***7) Definition Gamma (VESA)**

Based on Customer Sample, take the average value as a standard center value and the variation range of gamma value caused by loop voltage error should be between +/- 0.2. the bellow figure shows how to obtain the gamma curve and γ (from gray level: 0、4、8-----60、63).



# 9. RELIABILITY TEST CONDITIONS

**(A) Temperature、Humidity and Pressure**

| TEST ITEMS | CONDITIONS |
|---|---|
| High Temperature Operation | 50°C；250Hrs |
| High Temperature Storage | 65°C；250Hrs |
| High Temperature High Humidity Operation | 40°C；95% RH；250Hrs |
| High Temperature High Humidity Storage | 60°C；95% RH；48 Hrs |
| Low Temperature Operation | 0°C；250 Hrs |
| Low Temperature Storage | -25°C；250 Hrs |
| Thermal Shock | -40°C(30 Mins)～65°C(30 Mins)，100 CYCLE |
| Low Temperature Low Pressure Storage | 0℃、260hPa、24 Hrs |

**(B) Shock & Vibration**

| TEST ITEMS | CONDITIONS |
|---|---|
| Shock (Non-Operation) | Shock level : 2058m/s$^2$ (210G), Waveform : half sinusoidal wave, 2ms, 6 axis (± X,± Y,± Z) per cycle |
| Vibration (Non-Operation) | Vibration level : 14.7m/s$^2$ (1.5G), sinusoidal wave (each x, y, z axis : 1hr, total 3hrs)<br>Frequency range : 5～500 Hz<br>Sweep speed : 0.5 Octave/min. |

**(C) ESD**

| | Surface discharge (Panel display area、Frame) | | Electrics capacity of Connector |
|---|---|---|---|
| | Contact | Air | Contact |
| Capacity | 150 pF | 150 pF | 200 pF |
| Resistance | 330 Ω | 330 Ω | 0 Ω |
| Voltage | ±8kV | ±8kV/±15kV | ±250 V |
| Interval | 1 sec | 1 sec | 1 sec |
| Times(single point) | 25 | 25 | 1 |

**(D) MTBF without B/L : 200,000 Hrs(min) lifetime.**

**(E) 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.