# Chunghwa Picture Tubes, Ltd.
# Technical Specification

**To ：**

**Date： 2008**

*CPT TFT-LCD:*

## CLAA141WB03 N

**ACCEPTED BY：**

| APPROVED BY | CHECKED BY | PREPARED BY |
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## RECORD OF REVISIONS

| Revision No. | Date | Page | Description |
|---|---|---|---|
| V 1 | 2008/02/27 | | Final Version. |
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## CONTENTS

# 1. OVERVIEW

*CLAA141WB03 N* (with LVDS interface) is 14.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel , driver ICs , control circuit , and backlight.

By applying 6 bits digital data, 1280×800, 262K color images are displayed on the 14.1" diagonal screen. Input power voltage is single 3.3V for LCD driving.

Inverter for backlight is included in this module. General specifications are summarized in the following table:

| ITEM | SPECIFICATION |
|---|---|
| Display Area (mm) | 303.744 (H)x189.84 (V)<br>(14.1-inch diagonal) |
| Number of Pixels | 1280 ×3(H)×800(V) |
| Pixel Pitch (mm) | 0.2373(H)×0.2373(V) |
| Color Pixel Arrangement | RGB vertical stripe |
| Display Mode | Normally white |
| Number of Colors | 262,144 |
| Optimum Viewing Angle | 6 o'clock |
| Brightness (cd/m^2) | 220 cd/$m^2$ (5point)/6 mA (typ.) |
| Viewing Angle | 80/60 |
| Power Consumption (W)<br>(not included inverter) | 6.2 W (Typ) |
| Module Size (mm) | 319.5(W)×205.5(H)×5.5(D)（Max） |
| Module Weight (g) (include inverter) | 420 (Max) |
| Backlight Unit | 1CCFL |
| Surface Treatment | Anti-Glare (Haze Value 12%) |

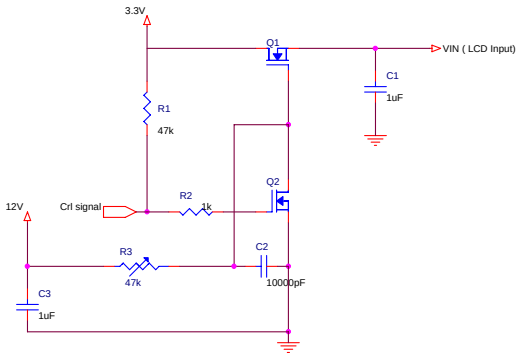
The LCD Products listed on this document are not suitable for use of aerospace equipment, submarine cables, nuclear reactor control system and life support systems. If customers intend to use these LCD products for above application or not listed in "Standard" as follows, please contact our sales people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

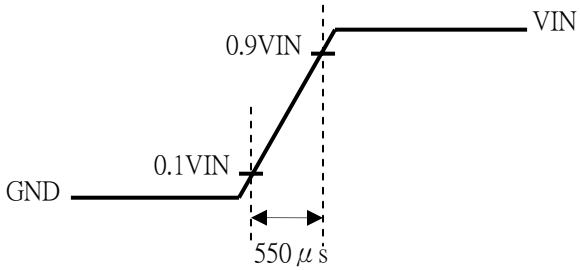
Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tool, Industrial robot, Audio and Visual equipment, Other consumer products.

## 2. ABSOLUTE MAXIMUM RATINGS

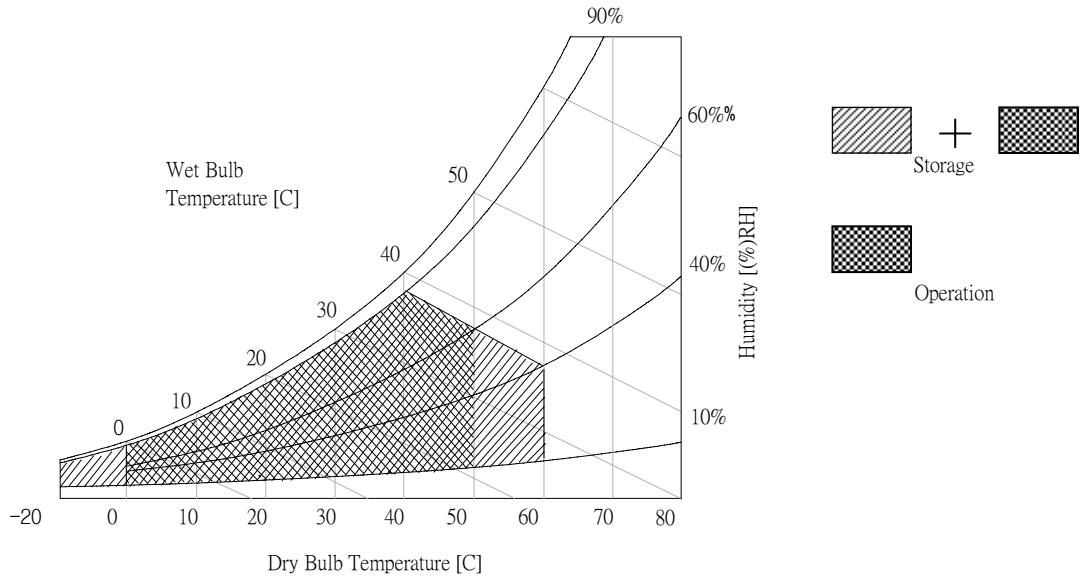
| ITEM | SYMBOL | MIN. | MAX. | UNIT | REMARK |
|---|---|---|---|---|---|
| Power Supply Voltage for LCD | VCC | -0.3 | 4.0 | V | |
| LVDS input Voltage | VIN | -0.3 | VCC+0.3 | V | |
| Static Electricity | VESDt | -250 | 250 | V | *1) |
| | VESDc | -15 | 15 | KV | |
| ICC Rush Current | $I_{RUSH}$ | -- | 2 | A | *2) |
| Operation Temperature | Top | 0 | 50 | ℃ | *3)*4) |
| Storage Temperature | Tstg | -20 | 60 | ℃ | *3)*4) |
| Starting Lamp Voltage | $V_{SL}$ | 0 | 1180 | V | |

[Note] ： *1) Test Condition：IEC 1000-4-2 ,
VESDt：Contact discharge to input connector
VESDc：Contact discharge to module
*2) measure with below circuit, If Vcc rise time increase then $I_{RUSH}$ decrease.




*3) Humidity ≦85% RH. without condensation.
*4) If the relative temperature and humidity out of range too long, it will affect visual of LCD



# 3. ELECTRICAL CHARACTERISTICS

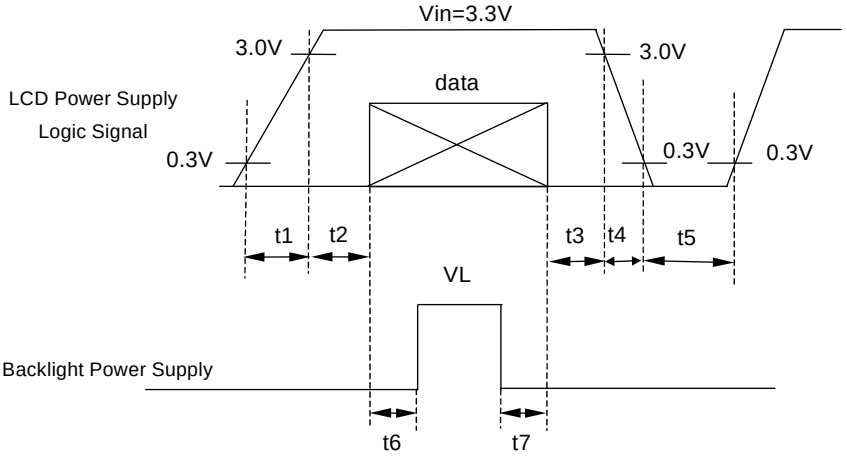
## (A) TFT LCD

Ta=25℃

| ITEM | | SYMBOL | MIN | TYP | MAX | UNIT | REMARK |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage for LCD | | VCC | 3.0 | 3.3 | 3.6 | V | *1) |
| Power Supply Current for LCD | | ICC | - | 340 | 380 | mA | *2) *3) |
| Rush Current | | Irush | - | - | 1.5 | A | |
| LVDS: IN+，IN- *3) | Input Voltage | VIN | 0 | - | VCC | V | |
| | Common Voltage | VCM | 1.125 | 1.25 | 1.375 | V | |
| | Differential Input Voltage | \| VID \| | 250 | 350 | 450 | mV | |
| | Threshold Voltage (Hihg) | VTH | - | - | 100 | mV | For VCM=+1.2V |
| | Threshold Voltage (Low) | VTL | -100 | - | - | mV | |
| Differential Input Voltage Tolerance | | △VID | - | - | 35 | mV | |
| Common Voltage Tolerance | | △VCM | - | - | 35 | mV | |

*1) Power Sequence：

1 ms＜t1≦10ms　　1 sec≦t5
0 ms＜t2≦50 ms　　200 ms≦t6
0 ms＜t3≦50 ms　　200 ms≦t7
0 ms＜t4≦10 ms

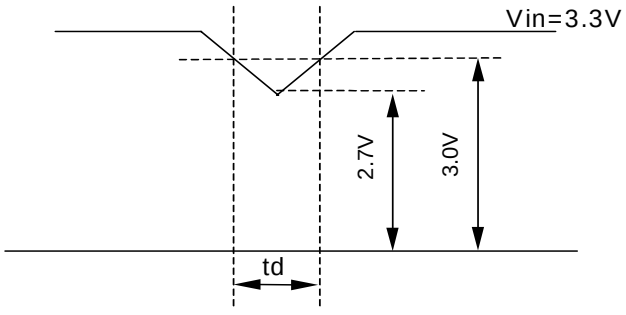



Data: RGB DATA, DCLK, HD, VD, DENA

VCC-dip state

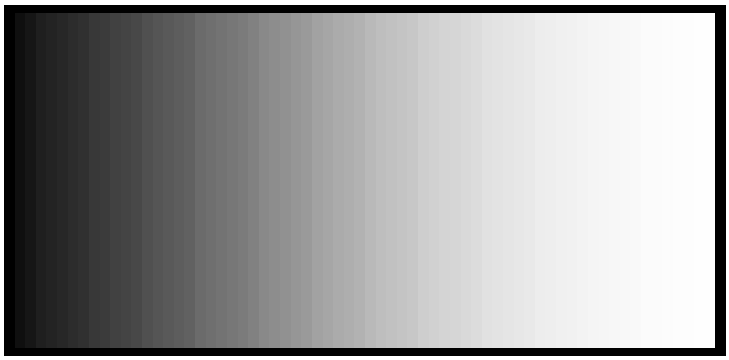
(1) when 3.0＞VCC≧2.7V，td≦10 ms

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

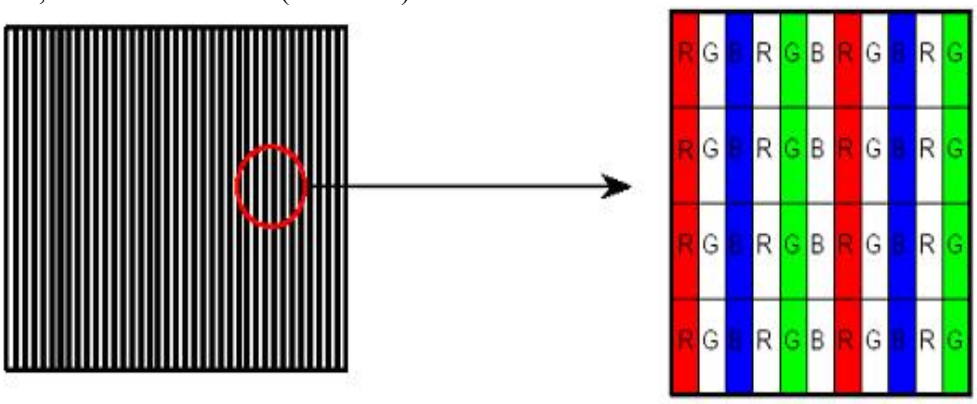


*2)

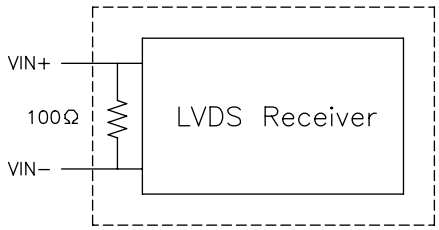
1.Typical value is measured when displaying horizontal gray scale Pattern:
0～63 gray level
VCC= +3.3V, fCLKin=71.1MHz (fV=60Hz)

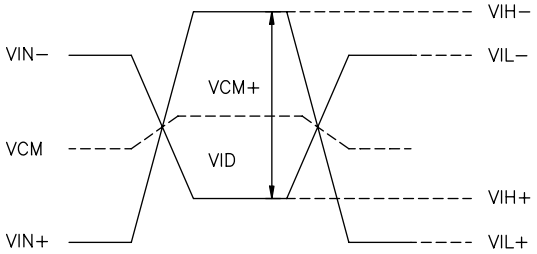


2. Max. value:
VCC= +3.3V, fCLKin=71.1MHz (fV=60Hz)




*3) LVDS Signal Definite：




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

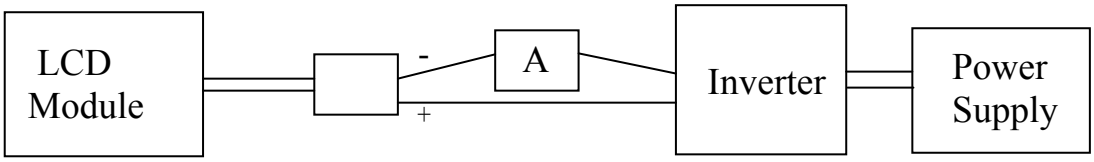
VID = $VIN_+$ – VIN-,
△VCM = | $VCM_+$–VCM- |,
△VID = | $VID_+$–VID- |,
VID+ = | $VIH_+$–VIH- |,
VID- = | $VIL_+$–VIL- |,
VCM =($VIN_+$ +VIN-)/2,
VCM+ =($VIH_+$ +VIH-)/2,
VCM- =($VIL_+$ +VIL-)/2,

**(B) BACK LIGHT**

Ta=25℃

| ITEM | | SYMBOL | MIN | TYP | MAX | UNIT | REMARK |
|---|---|---|---|---|---|---|---|
| Lamp Voltage(IL=6.0mA) | | VL | - | 640 | - | V | |
| Lamp Current | | IL | 3.0 | 6.0 | 6.5 | mA | *1) |
| Inverter Frequency | | FI | 50 | - | 60 | kHz | *3) |
| Lamp Life Time(IL=6.0mA) | | Life L | 15,000 | - | - | hr | *2) |
| Start up Lamp Voltage | Ta=0℃ | Vs | - | - | 1420 | V | *4) |
| | Ta=25℃ | | - | - | 1180 | | |

*1) Measure method：galvanometer connect to low voltage



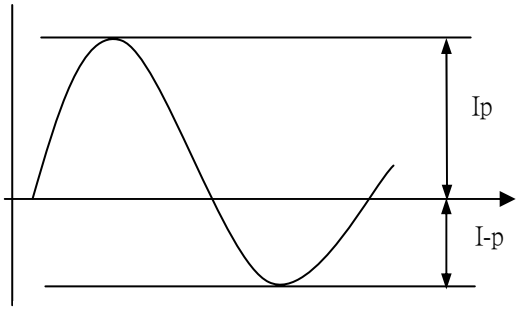

*2) Definition of the lamp life time：

a. Luminance (L) under 50% of specification starting lamp voltage
b. Starting Lamp Voltage: Vs=1180 V , Ta=25℃, IL=Max.6mA

[Note]

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

*3) 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. Under optimum operate frequency range (50~80 KHz), will not effect panel life-time and relability .

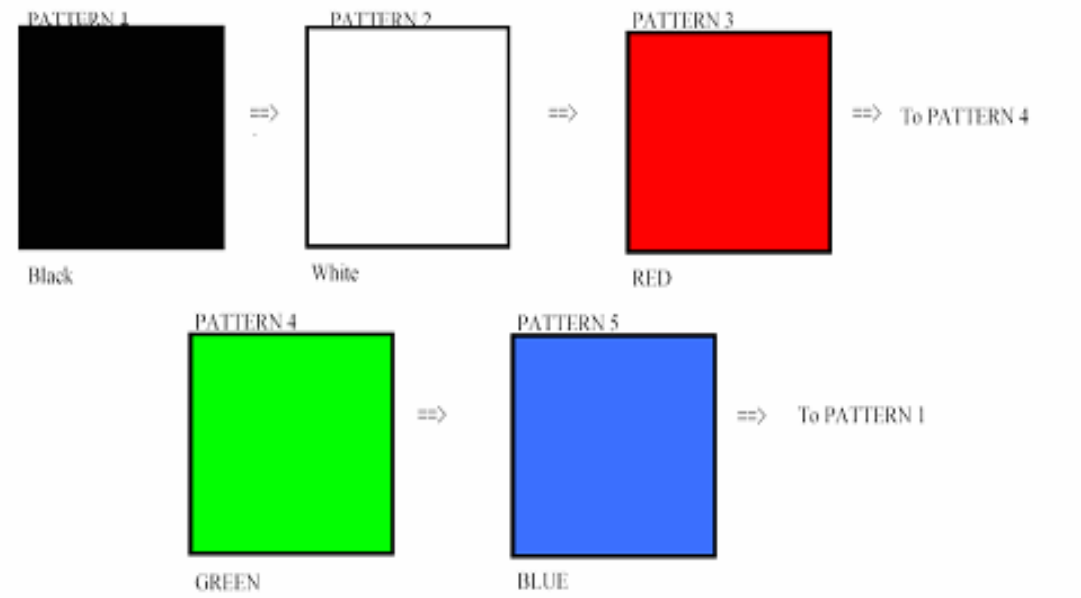
*4) For keeping good lighting situation ,when design the inverter,it must be considered that the voltage large than starting lamp voltage.

## 4. Connector Interface PIN & Function

(a) CN1(Interface signal)
Outlet connector: FI-XB30SL-HF10 (JAE)
Link connector: FI-X30H (JAE, Link Type )

| PIN # | SYMBOL | Function |
|---|---|---|
| 1 | Vss | Ground |
| 2 | Vin | +3.3V |
| 3 | Vin | +3.3V |
| 4 | V_EDID | DDC 3.3V Power |
| 5 | BIST | Panel BIST test |
| 6 | CLK_EDID | DDC Clock |
| 7 | DATA_EDID | DDC Data |
| 8 | R0M | LVDS Receiver Signal (-)—channel 0 |
| 9 | R0P | LVDS Receiver Signal (+)—channel 0 |
| 10 | Vss | Ground |
| 11 | R1M | LVDS Receiver Signal (-)—channel 1 |
| 12 | R1P | LVDS Receiver Signal (+)—channel 1 |
| 13 | Vss | Ground |
| 14 | R2M | LVDS Receiver Signal (-)—channel 2 |
| 15 | R2P | LVDS Receiver Signal (+)—channel 2 |
| 16 | Vss | Ground |
| 17 | RCLKM | LVDS Clock Signal (-) |
| 18 | RCLKP | LVDS Clock Signal (+) |
| 19 | Vss | Ground |
| 20 | NC | No connect |
| 21 | NC | VCOM test provided , but customer-end unused ; No Connect (open) |
| 22 | NC | No connect |
| 23 | NC | No connect |
| 24 | NC | No connect |
| 25 | NC | No connect |
| 26 | NC | No connect |
| 27 | NC | No connect |
| 28 | NC | No connect |
| 29 | NC | No connect |
| 30 | NC | No connect |

*1)BIST(Build in self-test pattern)
BIST pin = low(GND)：Normal
BIST pin = high(VCC)：Self-test mode
1) Self-test Display Pattern will change when pin 5 is at high voltage and no LVDS input signals would be detected, as following patterns runs continuously. ( Black, White, Red, Green and Blue).
2) Pattern sequence
Pattern1→ Pattern2→ Pattern3→ Pattern4→ Pattern5→Pattern1→……..




(b) CN2 (BACKLIGHT)

Backlight-side connector: BHSR-02VS-1 (JST)

Inverter-side connector: SM02B-BHSS-1 (JST)

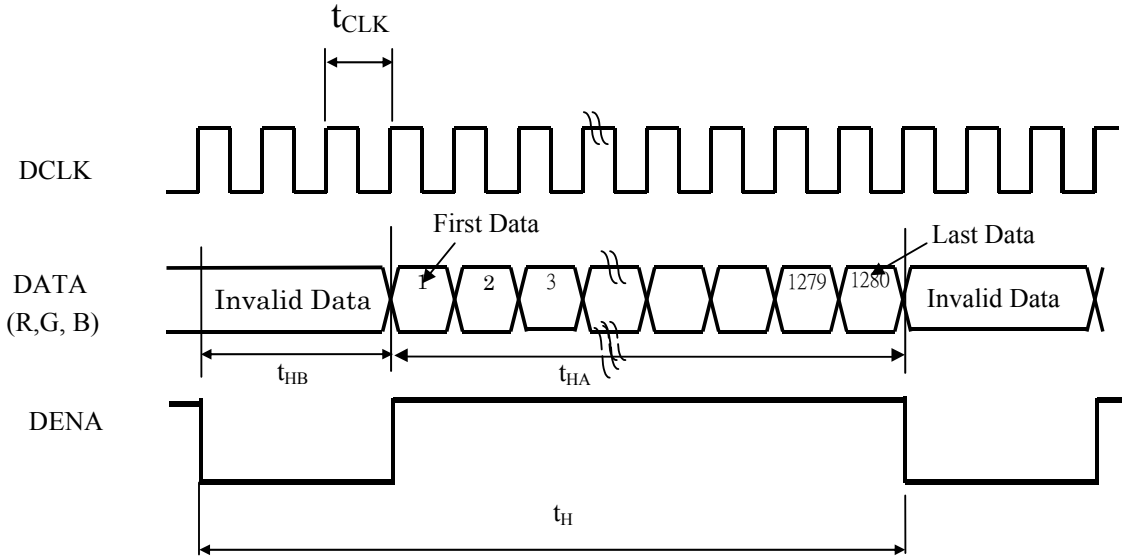
| PIN # | Symbol | Function |
|---|---|---|
| 1 | CTH | VBLH (High) |
| 2 | CTL | VBLL (Low) |

[Note]： VBLH-VBLL=VL

# 5. INTERFACE TIMING CHART

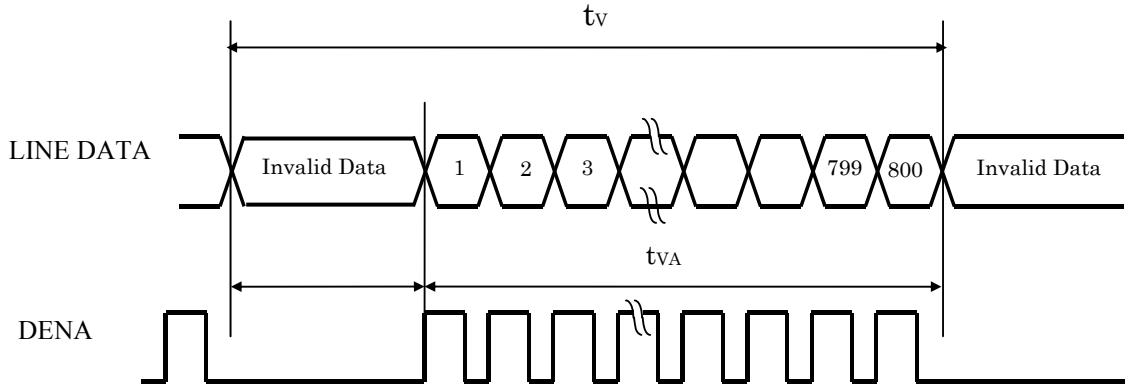
**(a). LVDS input time sequence**

Horizontal signal:




**(b) LCD input time sequence**

Vertical signal:




**(c) Timing Chart**

| ITEM | | | | SYMBOL | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| LVDS Input Timing | CLK frequency | | | fCLKin | 62.83 | 71.11 | 80.42 | MHz |
| | CLK period | | | tCLKin | 12.43 | 14.06 | 15.92 | ns |
| LCD input signal ( LVDS Transmitter Input ) | DENA | Horizonta | Total | $t_H$ | 1400 | 1440 | 1480 | tCLK |
| | | | Active | $t_{HA}$ | 1280 | 1280 | 1280 | tCLK |
| | | | Blank | $t_{HB}$ | 120 | 160 | 200 | tCLK |
| | | Vertical | Frame Rate | fV | 55 | 60 | 65 | Hz |
| | | | Tatol | $t_V$ | 816 | 823 | 836 | $t_H$ |
| | | | Active | $t_{VA}$ | 800 | 800 | 800 | $t_H$ |
| | | | Blank | $t_{VB}$ | 16 | 23 | 36 | $t_H$ |

**[Note]**

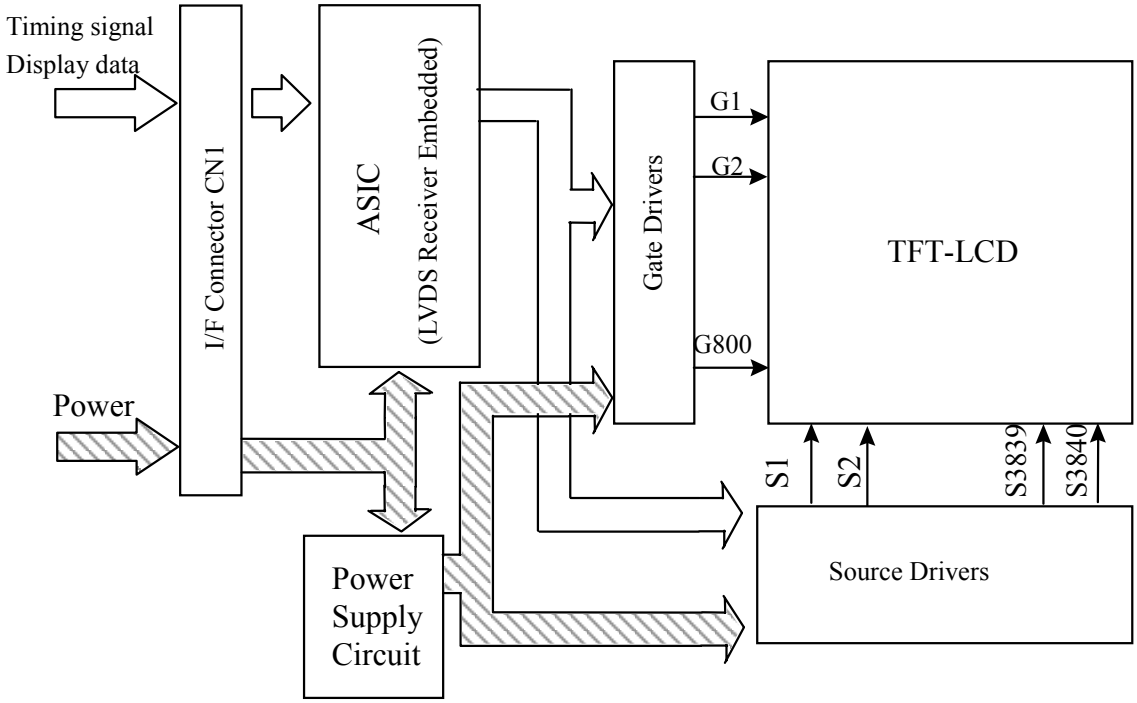
1） Data is latched at fall edge of DCLK in this specification.
2） DENA (Data Enable) should always be positive polarity as shown in the timing specification.
3） CLKIN should appear during all invalid period.
4） T(period) = 1/f

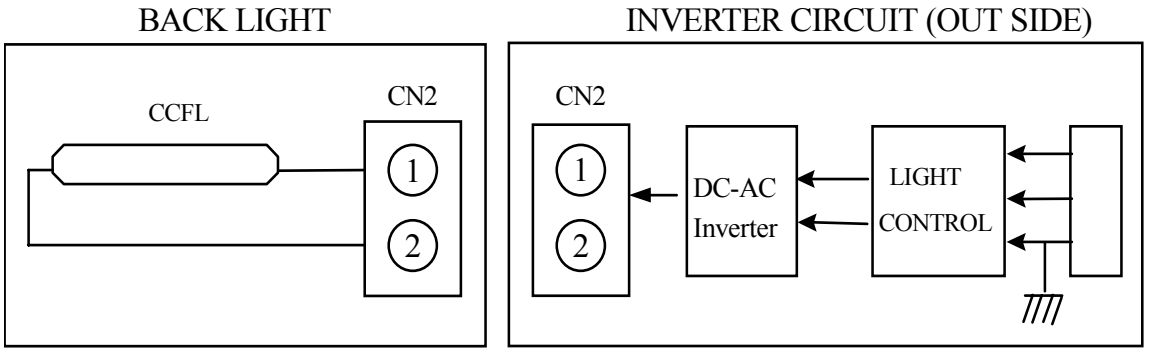
**(d) DATA mapping**

| 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) Definition of gray scale:
Color(n) : n means level of gray scale .
Bigger n means brighter level.
(2) Data : 1= High , 0 = Low

## 6. BLOCK DIAGRAM

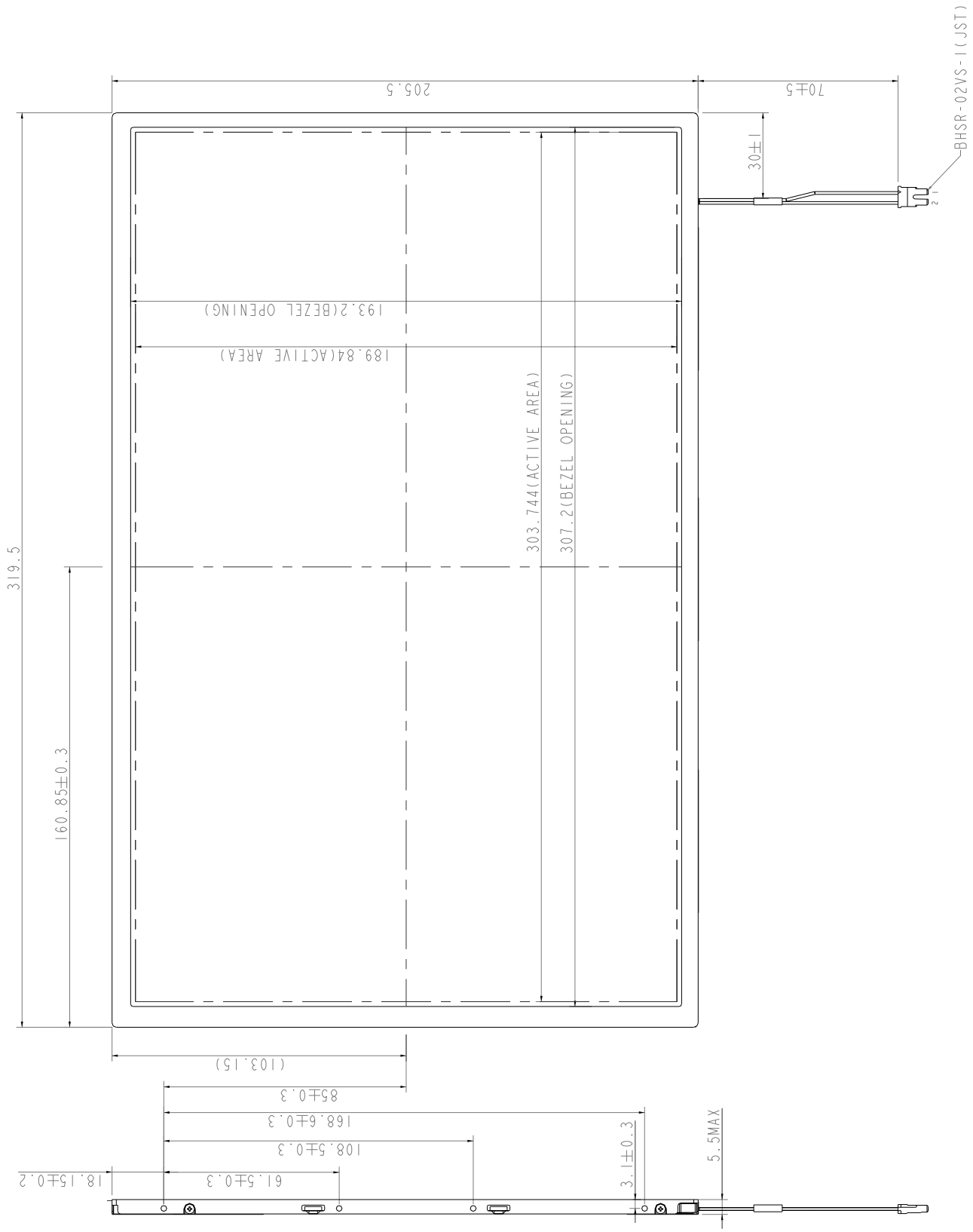


# 7. MECHANICAL SPECIFICATION

**(1) Front side**

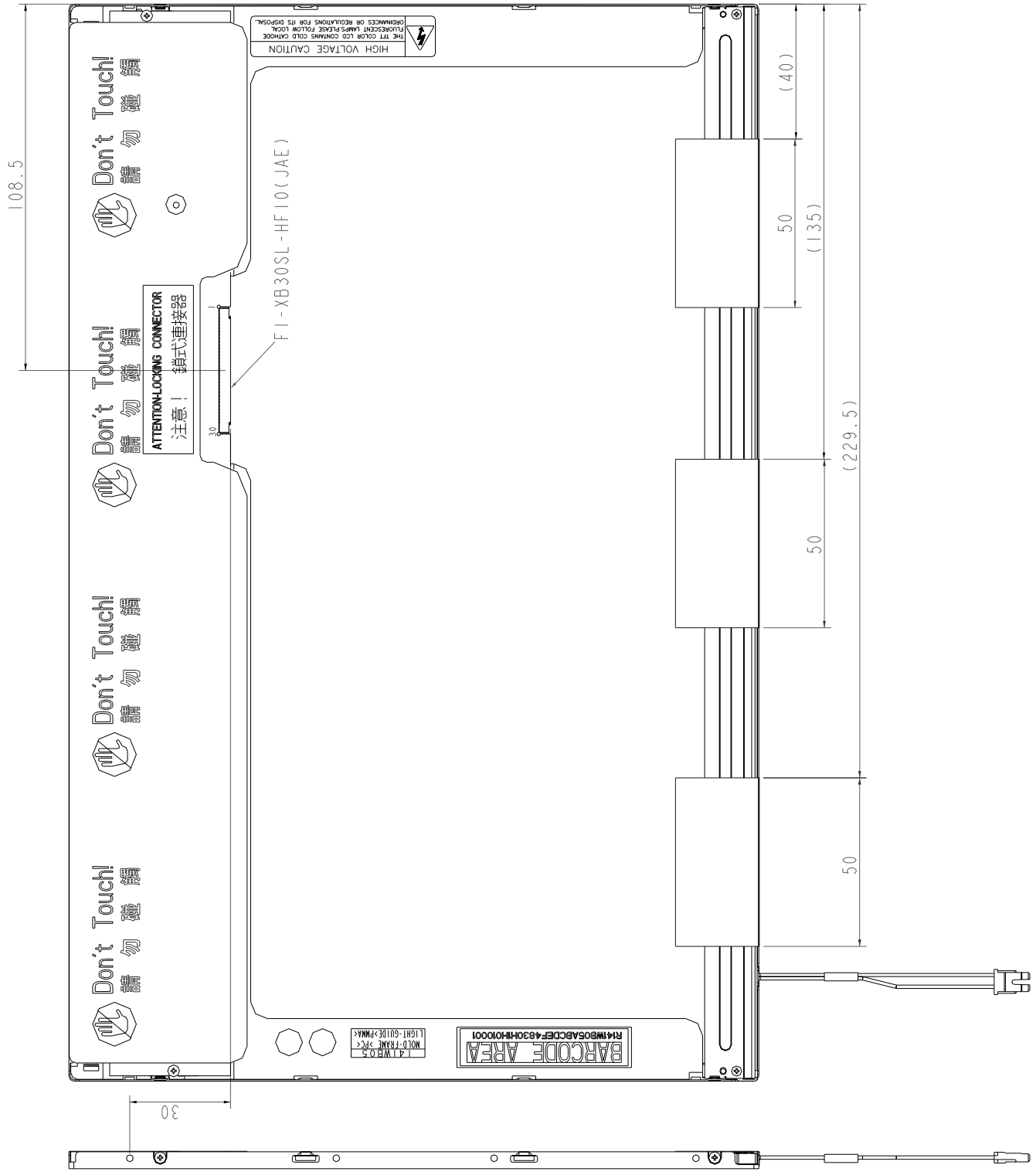
**The tolerance is ±0.5mm unless noted.** **[Unit： mm]**




The tolerance, not show in the figure, is ±0.5mm.

2) Rear side

[Unit： mm]



# 8. OPTICAL CHARACTERISTICS

Ta = 25°C, VCC=3.3V

| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | Remark |
|---|---|---|---|---|---|---|---|---|
| Contrast | | CR | *1) | 300 | 350 | -- | -- | *1) |
| Luminance (5P) | | L | *3) $I_L$ = 6 mA | 200 | 220 | -- | cd/m$^2$ | *3) |
| 5P Luminance Uniformity | | ΔL | *4) | 80 | -- | -- | % | *3) |
| Response Time | | Tr | *6) | -- | 9 | -- | ms | *6) |
| | | Tf | | -- | 16 | -- | | |
| View angle | Horizontal | $\phi^{*2)}$ | *2)CR≧10 | -35~35 | -40 ~ 40 | -- | ° | *2) |
| | Vertical | $\theta^{*2)}$ | | -35~15 | -40 ~ 20 | -- | ° | |
| Image sticking | | tis | *7) | -- | -- | 20 | min | |
| Color Temperature Coordinate | Red | x | θ=ϕ= 0° | 0.559 | 0.589 | 0.619 | -- | |
| | | y | | 0.296 | 0.326 | 0.356 | | |
| | Green | x | | 0.285 | 0.315 | 0.345 | | |
| | | y | | 0.510 | 0.540 | 0.570 | | |
| | Blue | x | | 0.123 | 0.153 | 0.183 | | |
| | | y | | 0.095 | 0.125 | 0.155 | | |
| | White | x | | 0.283 | 0.313 | 0.343 | | |
| | | y | | 0.299 | 0.329 | 0.359 | | |

These items are measured using BM-5A (TOPCON) under the dark room condition (no ambient light).
Measurement Condition: IL=6.0mA
Inverter: SUMIDA TWS-400-9594.

Measured point: Figure2
Viewing angle of measurement: Front side without pointed. (Figure1 $\theta = \phi = 0°$)

*1) Definition of Contrast Ratio： CR=ON(White)Luminance/OFF(Black)Luminance
*2) Definition of Viewing Angle(θ, $\phi$ )

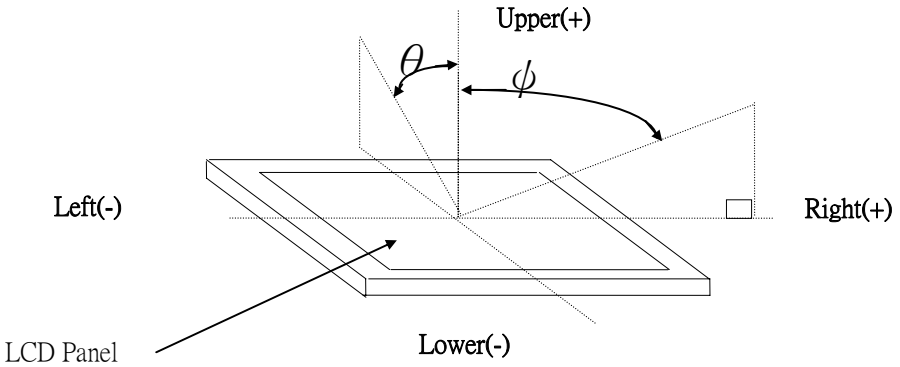



Figure1

*3) Definition of Luminance and Luminance uniformity：

Definition of Average Luminance of White (L)

Measure White Luminance on the below center(5)，5 point(5,10,11,12,13)

L= [L(5)+L(10)+L(11)+L(12)+L(13)]/5

L(X) is corresponding to the luminance of the point X at below Figure.

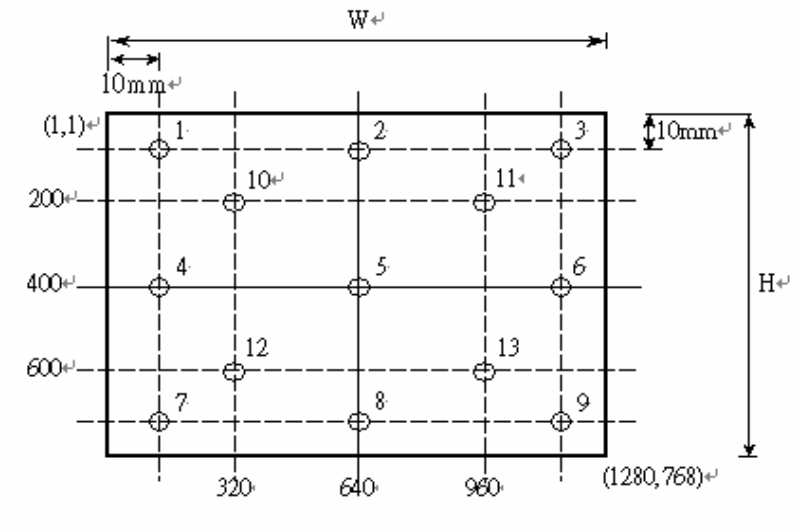



Figure 2

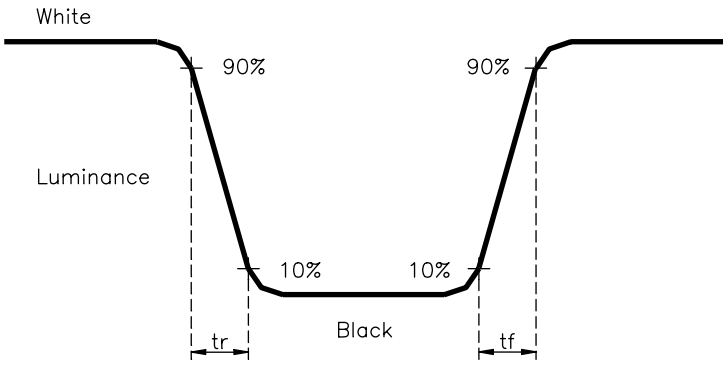
*4) Definition of Luminance Uniformity

△ L = [L(MIN) / L(MAX)] x 100

*5) Definition of Contrast Ratio Uniformity

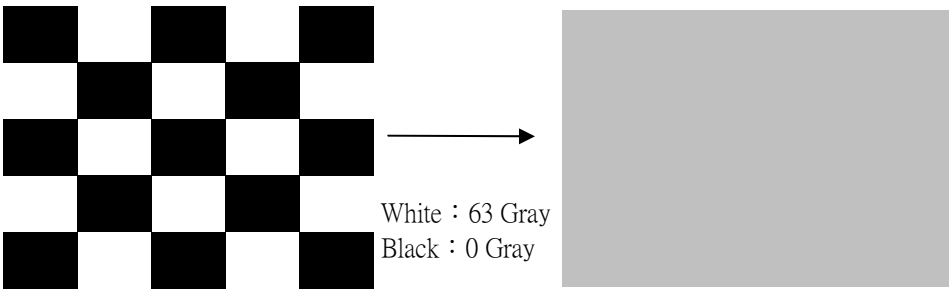
△ CR = [CR(MAX) / CR(MIN) - 1] x 100

*6) Definition of Response Time



*7) Definition of Image Sticking

Continuously display the test pattern shown in the figure below for 16 hours. Then display a completely white s creen. The previous image shall not persist more than 20 mins at 25℃.



# 9.RELIABILITY TEST CONDITIONS:

**(1) Temperature and Humidity**

| TEST ITEMS | CONDITIONS |
|---|---|
| High Temperature Operation | 50°C ；240Hrs |
| High Temperature Storage | 60°C ；240Hrs |
| High Temperature<br>High Humidity Operation | 50°C ；90% RH；240Hrs |
| High Temperature High Humidity Storage | 60°C ；90% RH；48 Hrs |
| Low Temperature Operation | 0°C ；240 Hrs |
| Low Temperature Storage | -20°C ；240 Hrs |
| Thermal Shock | -20°C(0.5 hr)～60°C(0.5 hr)，<br>Ramp<20℃，100 CYCLE |
| Temperature & Pressure Storage | 25°C ；260hPa(about 10000m)，24 Hrs |

**(2) Shock & Vibration**

| TEST ITEMS | CONDITIONS |
|---|---|
| Shock<br>(Non-Operation) | Shock level : 1960m/s$^2$ (200G), Waveform : half sinusoidal wave, 2ms, 6 axis (± X,± Y,± Z) per cycle |
| Vibration<br>(Non-Operation) | Vibration level : 9.8m/s$^2$ (1.0G), sinusoidal wave (each x,y,z axis : 1hr, total 3hrs)<br>Frequency range : 5～500 Hz<br>Sweep speed : 0.5 Octave/min. |

**(3) ESD**

| | Surface discharge(Panel display area、Frame、PWB、Panel back side) | | 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 |

| Acceptance Criteria | Air Discharge | Air Discharge |
|---|---|---|
| | +/-8 kV | +/-15 kV |
| A | Permitted | Permitted |
| B | Permitted | Permitted |
| C | Not Permitted | Permitted |
| D | Not Permitted | Not Permitted |

| Acceptance Definitions | |
|---|---|
| A | Normal operation. No degradation. No failures. |
| B | Some performance degradation allowed. No data lost. Self-recoverable. |
| C | Temporary performance degradation. Recovery by operator is acceptable. |
| D | Degradation or loss of function,which is not recoverable due to damage of equipment (components) |

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

**(5) 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.

# 10. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling- TFT-LCD products;

10.1 ASSEMBLY PRECAUTION

(1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.

(2) Please design display housing in accordance with the following guidelines.

- Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
- Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
- When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
- Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.
- Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.

(3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

(4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.

(5) Please wipe out LCD panel surface with absorbent cotton or soft clothe in case of it being soiled.

(6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

(7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

(8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

(9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

10.2 OPERATING PRECAUTIONS

(1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.

(2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.

(3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

(4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.

(5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.

(6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

10.3 PRECAUTIONS WITH ELECTROSTATICS

(1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.

(2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

10.4 STORAGE PRECAUTIONS

(1) When you store LCDs for a long time, it is recommended to keep the temperature between 0℃ ~40℃ without the exposure of sunlight and to keep the humidity less than 90%RH.

(2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60℃ 90%RH.

(3) Please do not leave the LCDs in the environment of low temperature; below -20℃.

10.5 SAFETY PRECAUTIONS

(1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off throughly with soap and water.

10.6 OTHERS

(1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays.

(2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

(3) For the packaging box, please pay attention to the followings:

- Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.
- Please do not pile them up more than 3 boxes. (They are not designed so.) And please do not turn over.
- Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)