# Chunghwa Picture Tubes, Ltd.
# Technical Specification

| To | : | HAO SHENG |
|---|---|---|
| Date | : | 2009/07/29 |

*CPT TFT-LCD*
## CLAA 170EA10

ACCEPTED BY：

| APPROVED BY | CHECKED BY | PREPARED BY |
|---|---|---|
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Prepared by : Design General Division

**CHUNGHWA PICTUER TUBES, LTD.**

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## Modification Record List

| NO. | Issue Date | Modification Index | Modifier |
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# Table Of Content

# 1. OVERVIEW

CLAA170EA10 is 17.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 8 bit digital data(6 bit+Hi-FRC),1280×1024, 16.7M-color images are displayed on the 17.0" diagonal screen. Input power voltage is 5.0V for LCD driving. Inverter for backlight is not included in this module. General specifications are summarized in the following table:

| ITEM | SPECIFICATION |
|---|---|
| Display Area(mm) | 337.920(H)x270.336(V)        (17.0-inch diagonal) |
| Number of Pixels | 1280(H)x1024(V) |
| Pixel Pitch(mm) | 0.264(H)x0.264(V) |
| Color Pixel Arrangement | RGB vertical stripe |
| Display Mode | normally white, TN |
| Number of Colors | 16.7M (6 Bit+Hi-FRC) |
| Brightness(cd/m^2) | 250cd/m$^2$(Typ.)(Center point, Lamp current=8.0 mA) |
| Viewing Angle | 170 / 160(Typ.) |
| Surface Treatment | Anti-glare |
| Power consumption(W) | 13.1 (Typ.) |
| Module Size(mm) | 358.5(W)x296.5(H)x17.5(D)(max) |
| Module Weight(g) | 1900g(typ) ±100 |
| Backlight Unit | CCFL, 2 tables, edge-light(top*1/bottom*1) |

## 2. ABSOLUTE MAXIMUM RATINGS

| ITEM | | SYMBOL | MIN. | MAX. | UNIT | REMARK |
|---|---|---|---|---|---|---|
| Power Supply Voltage for LCD | | VCC | 0 | 6 | V | |
| Lamp Voltage | STI | VL | 540 | 760 | Vrms | |
| | Delta | VL | 531 | 690 | Vrms | |
| Lamp Current | STI | ILO | 3 | 8.5 | mArms | *4). 7) |
| | Delta | ILO | 3 | 8.5 | mArms | |
| Lamp Frequency | | FL | 40 | 80 | kHz | |
| static electricity | | VESDt | -200 | 200 | V | *5) |
| | | VESDc | -8000 | 8000 | V | |
| Operation Temperature | | Top | 0 | 50 | ℃ | *1). 2). 3). 6) |
| Storage Temperature | | Tstg | -20 | 60 | ℃ | *1). 2). 3) |
| Delayed Discharge Time | | TD | -- | 1 | sec | *8) |

[Note]

1). The relative temperature and humidity ranges are as below sketch, 90%RHMax.(Ta$\leqq$40℃).

2). The maximum wet bulb temperature $\leqq$39℃(Ta＞40℃) and without dewing.

3). If you use the product in a environment which over the definition of temperature and humidity too long to effect the result of eye-aching.

4). The life time of the lamp is related to the current of the lamp, so please according to the description of the "(b) backlight" on page 7.

5). Test Condition: IEC 1000-4-2

　　　　VESDt: Contact discharge to input connector; VESD$_C$: Contact discharge to module

6). If you operate the product in normal temperature range, the center surface of panel should be under 60℃.

7). When lamp current is out of the absolute maximum range, the life will fall rapidly or shown unusual sign.
IL min 2mA only for test only, but we can't guarantee the lifetime and performance.

8). Delay lighting testing needs the volt above start voltage Vrms. Before the procedure tube needs typical lighting for 1 minute and stay in the temperature 25±2℃ for 24 hours and then testing in the same condition in dark room.
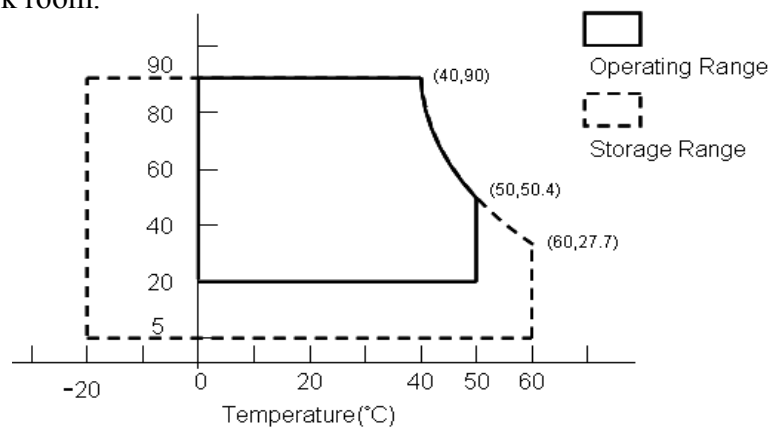
# 3. ELECTRICAL CHARACTERISTICS

## (1).TFT-LCD

Ta=25℃

| ITEM | | SYMBOL | MIN | TYP | MAX | UNIT | Remark |
|---|---|---|---|---|---|---|---|
| Power Supply Voltage for LCD | | Vcc | 4.5 | 5.0 | 5.5 | V | *1) |
| Power Supply Current for LCD | | Icc | - | 700 | 950 | mA | *2) |
| Permissive Input Ripple Voltage | | VRP | - | - | 100 | mVp-p | Vcc=5.0V |
| Differential impedance | | Zm | 90 | 100 | 110 | Ω | |
| Logic input voltage LVDS:IN+，IN- | Common Mode Voltag | VCM | 1.125 | 1.25 | 1.375 | V | |
| | Differential Input Voltage | \|VID\| | 250 | 350 | 450 | mV | |
| | Threshold Voltage(High) | VTH | - | - | 100 | mV | *3) |
| | Threshold Voltage(Low) | VTL | -100 | - | - | mV | |
| LCD Inrush Current | | Inrush | | | 3 | A | *4) |
| Power consumption | | P | | 3.5 | 4.75 | W | *2) |

[Note]

1).VCC-turn-on conditions:

0.5ms≦t1≦10ms      1 sec≦t4

0＜t2≦50ms      200ms≦t5

0＜t3≦50ms      200ms≦t6



Data: RGB DATA, DCLK, DENA
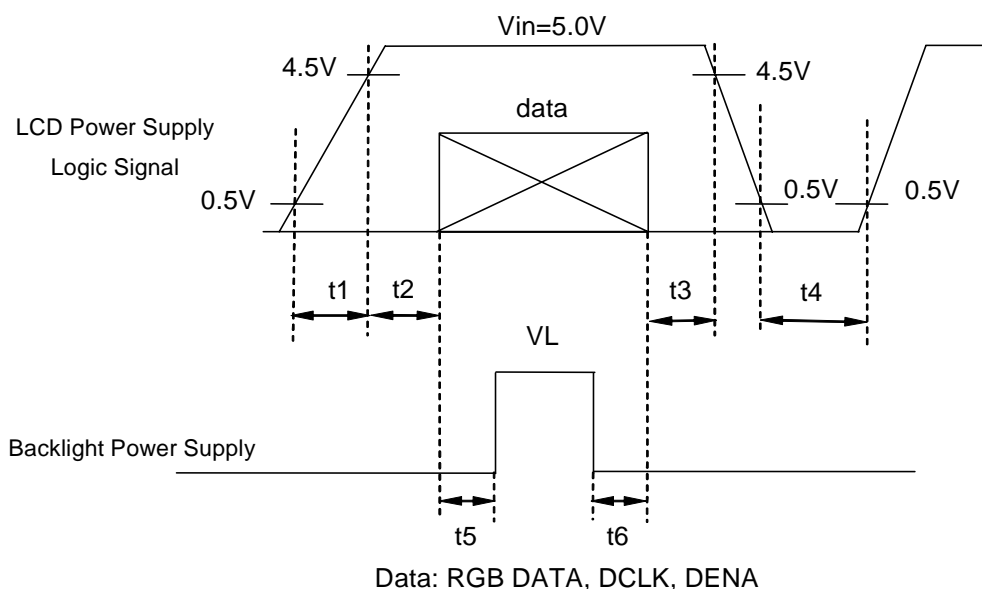
VCC-dip conditions:

(1) When 3.6V≦Vcc (min) <4.5V & td≦10 ms, module works well.

(2) When VCC <3.6 V, VCC-dip conditions should also follow the VCC-turn-on conditions.
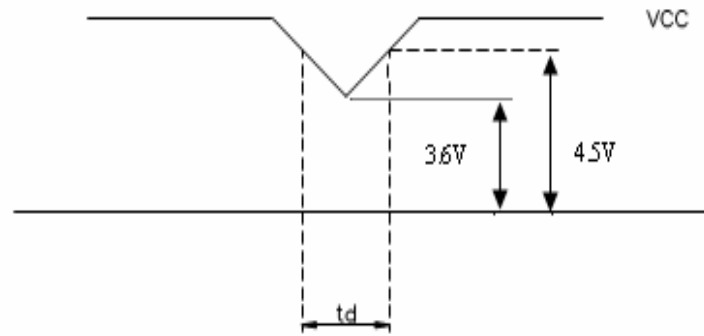
2).Typical current situation: 64 gray scale level,1280 line mode, VCC=5.0V, Fh=64Khz,Fv=60Hz,
f$_{CLK}$=54 MHz.

3).LVDS Signal definition:
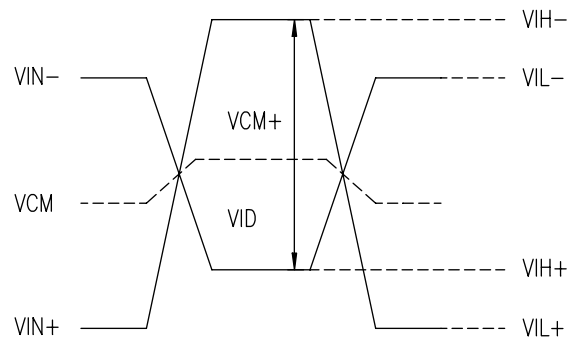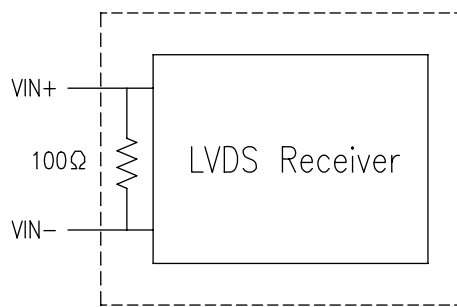


$VID = VIN_+ - VIN$- ,
$\triangle VCM = |VCM_+ - VCM$- $|$ ,
$\triangle VID = |VID_+ - VID$- $|$ ,
$VID+ = |VIH_+ - VIH$- $|$ ,
$VID- = |VIL_+ - VIL$- $|$ ,
$VCM = (VIN_+ + VIN$-$)/2$,
$VCM+ = (VIH_+ + VIH$-$)/2$,
$VCM- = (VIL_+ + VIL$-$)/2$,

$VIN_+$ = Positive differential DATA & CLK Input
$VIN$- = Negative differential DATA & CLK Input

4).Irush Measurement Condition
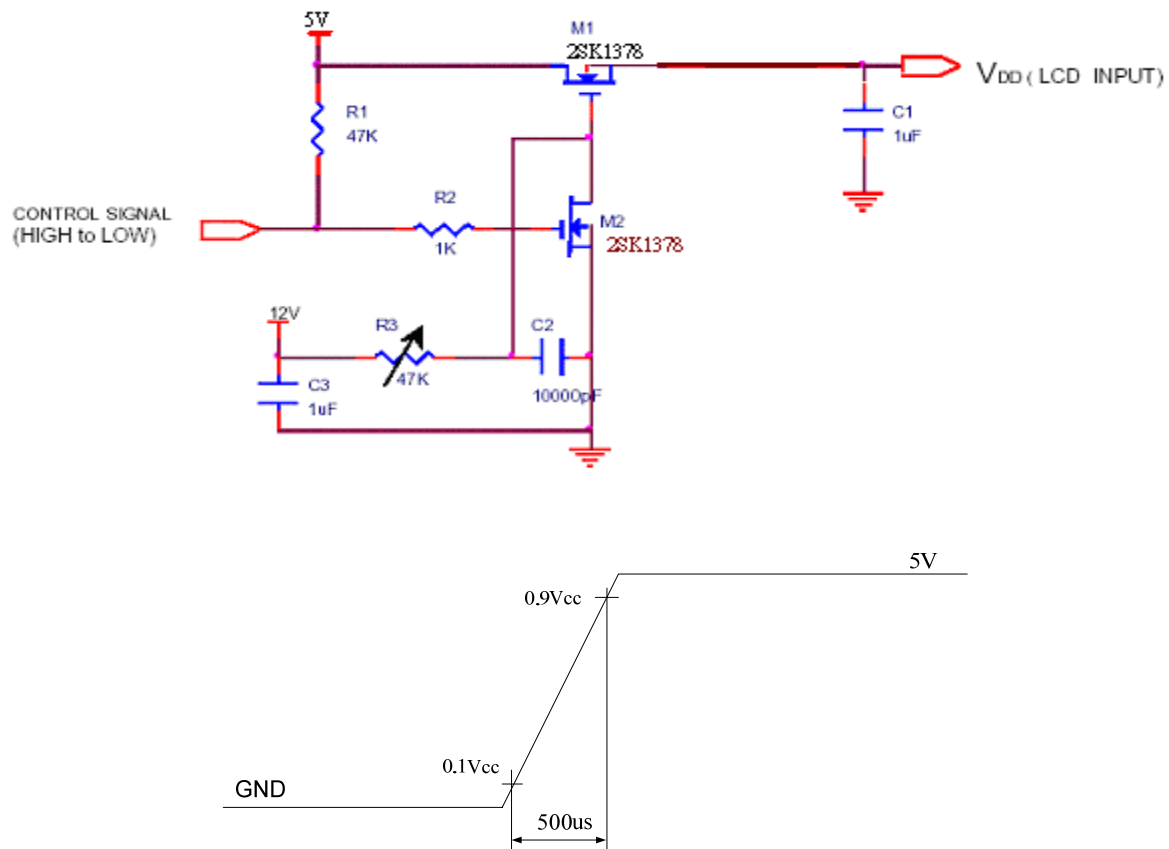
## (2).Backlight

1. Electrical specification

| ITEM | | SYMBOL | MIN | TYP | MAX | UNIT | REMARK |
|---|---|---|---|---|---|---|---|
| B/L Voltage | STI | VL | 540 | 600 | 660 | Vrms | IL=8.0mA |
| | Delta | VL | 531 | 590 | 649 | Vrms | Ta=25℃ |
| B/L Current | | IL | 3 | 8 | 8.5 | mArms | *1) Ta=25℃ |
| B/L operating current | | ILO | 7.5 | 8 | 8.5 | mArms | *1) Ta=25℃ |
| B/L power consumption | | WL | ― | 9.6 | ― | W | IL=8.0mA Ta=25℃ |
| Inverter Frequency | | FI | 45 | 50 | 55 | kHz | *2) Ta=25℃ |
| Starting Lamp Voltage | STI | VS | ― | ― | 1300 | Vrms | Ta=0℃ |
| | | | ― | ― | 1100 | Vrms | Ta=25℃ |
| | Delta | VS | ― | ― | 1600 | Vrms | Ta=0℃ |
| | | | ― | ― | 1100 | Vrms | Ta=25℃ |

2. Lamp life time

| ITEM | | ILO at 2.0 mA | ILO at 3.0 mA | ILO at 8.0 mA | ILO at 8.5 mA | -- | UNIT | REMARK |
|---|---|---|---|---|---|---|---|---|
| Lamp life Time | STI | ― | Min. 50,000 | Min. 50,000 | Min. 50,000 | -- | hr | Continuous Operation *3) |
| | Delta | ― | Min. 50,000 | Min. 50,000 | Min. 40,000 | -- | | |
| Rated time (turn on/off) | | ― | ― | Min.100,000 | ― | ― | time | *4) |

[Note ] Measuring inverter Type：CVT SIT-22FA3

If the waveform of light up-driving is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Arm 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:
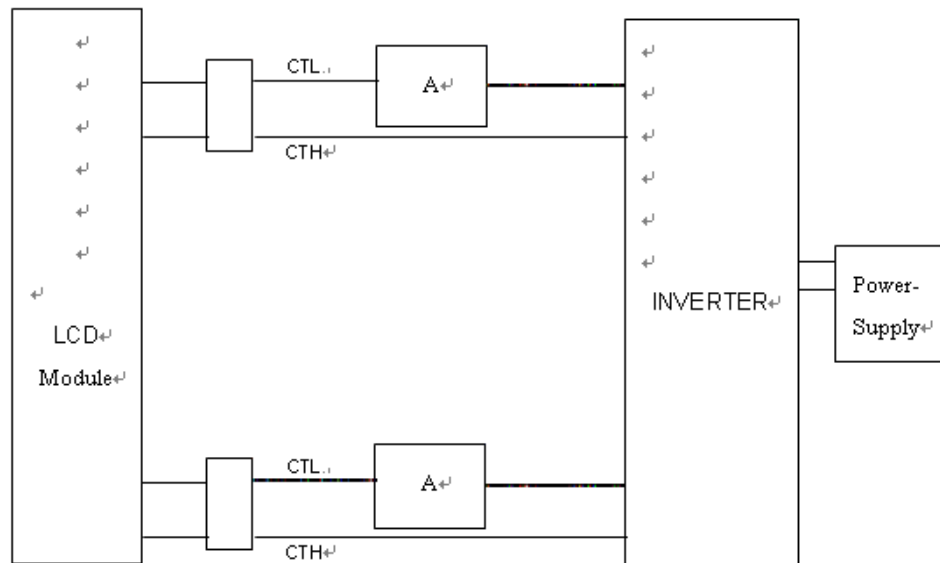
・The degrees of unbalance： ＜10%

・The ratio of wave height：＜√2 ±10%
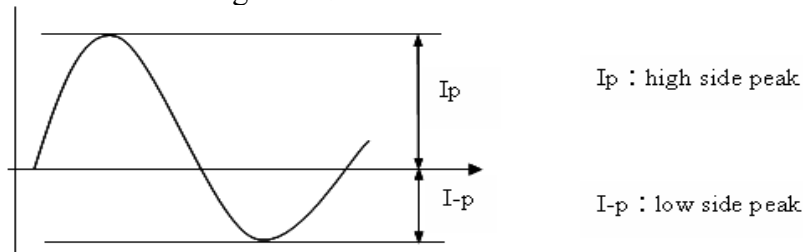


A：The degrees of unbalance ＝ |Ip － I-p |/ Irms ×100 (%)
B：The ratio of wave height ＝ Ip (or I-p) / Irms

1) Lamp Current measurement method (The current meter is inserted in cold line)



2) a.Frequency in this range can mala the characterisitics of electric and optics maintain in +/- 10% except hue.

b.If the lamp frequency can be maintain in 50~60KHz, the better charactristics of the electrical and the optical can be presented.

c.If the operating frequency is 40~80 KHz, the life time and the reliability of the lamp will not be affect.

d.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) Definition of the lamp life time： Luminance (L) under 50% of specification starting lamp voltage or starting lamp voltage is more than 130% of the initial value

4) The condition of Turn-on and Turn-off operation is as below:

a. Lamp current is 8.0mA

b. Frequency is 10 sec.(on)/10 sec.(off)

c. Repeat it for 10 thousand times

d. The result of eye-etching of the lamp hue is normal, and can switch the lamp.

It should not have motion fail when starting lamp voltage is lower than 130% of the initial value.

5) It is necessary to consider the maximal value when design inverter，in order to assure lighting**.**

6) The equation of power consumption WL=IL x VL x 2.(IL=8.0mA，Ta=25℃)

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

8)  WL=IL x VL x2。(IL=8.0mA，Ta=25℃)

9) The Starting Lamp Voltage (VS) of inverter must be driven large than one second.

10) The output voltage of inverter (Vn) must be the same phase of between any lamps.

11) The difference in voltage between any lamps($\triangle$V) must be smaller than 300V at the same time.

   Example：│$\triangle$V│＜300V，$\triangle$V： =V1(t)-V2(t)

12) $\dfrac{|Vnrms - VL|}{VL} \leq 15\%$ ，n=1，2… 4，n：the number of lamp
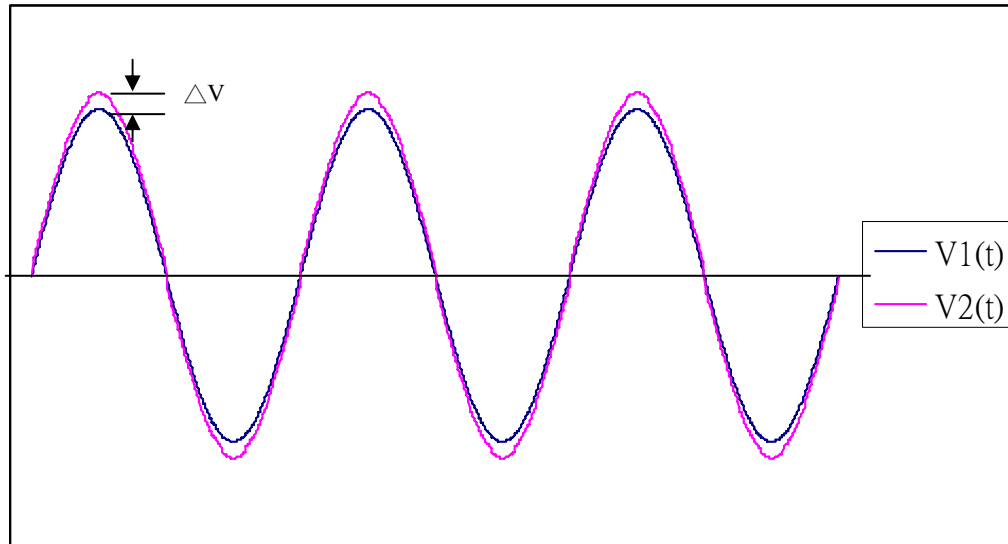


13) The lamp working current (Icyc) of any cycle of lighting driving wave can't exceed maximum of lamp standard working current (IL).Therefore, the inverter design should be avoided the state.

Note：

1. VL：The lamp voltage(typical) of the standard working current.

2. The lamp working current (Icyc) is defined the RMS of current cycle from the oscilloscope.

# 4. INTERFACE PIN CONNECTION

(1) CN1 (Data Signal and Power Supply)

Used connector: FI-XB30SSRL-HF16 (JAE) or compatible.

| PIN NO. | SYMBOL | FUNCTION |
|---|---|---|
| 1 | RXO0- | negative signal of odd channel 0(LVDS) |
| 2 | RXO0+ | positive signal of odd channel 0(LVDS) |
| 3 | RXO1- | negative signal of odd channel 1(LVDS) |
| 4 | RXO1+ | positive signal of odd channel 1(LVDS) |
| 5 | RXO2- | negative signal of odd channel 2(LVDS) |
| 6 | RXO2+ | positive signal of odd channel 2(LVDS) |
| 7 | GND | Ground |
| 8 | RXOC- | negative signal of odd clock channel (LVDS) |
| 9 | RXOC+ | positive signal of odd clock channel (LVDS) |
| 10 | RXO3- | negative signal of odd channel 3(LVDS) |
| 11 | RXO3+ | positive signal of odd channel 3(LVDS) |
| 12 | RXE0- | negative signal of even channel 0(LVDS) |
| 13 | RXE0+ | positive signal of   even channel 0(LVDS) |
| 14 | GND | Ground |
| 15 | RXE1- | negative signal of even channel 1(LVDS) |
| 16 | RXE1+ | positive signal of even channel 1(LVDS) |
| 17 | GND | Ground |
| 18 | RXE2- | negative signal of even channel 2(LVDS) |
| 19 | RXE2+ | positive signal of even channel 2(LVDS) |
| 20 | RXEC- | negative signal of even clock channel (LVDS) |
| 21 | RXEC+ | positive signal of even clock channel (LVDS) |
| 22 | RXE3- | negative signal of even channel 3(LVDS) |
| 23 | RXE3+ | positive signal of even channel 3(LVDS) |
| 24 | GND | Ground |
| 25 | NC | NC |
| 26 | NC | NC |
| 27 | NC | NC |
| 28 | VCC | Power supply input voltage(5.0 V) |
| 29 | VCC | Power supply input voltage(5.0 V) |
| 30 | VCC | Power supply input voltage(5.0 V) |

(2) CN2, 3, 4, 5 (BACKLIGHT)

Backlight-side connector: 35001HS-02L (YEONHO)

Inverter-side connector: SM02 (4.0) B-BHS-1-TB (JST)

| Pin No. | Symbol | Function |
|---|---|---|
| 1 | CTH | Power for CCFL |
| 2 | CTL | Power return for CCFL |

# 5. INTERFACE TIMING

(1) Timing Specifications

| ITEM | | | SYMBOL | MIN | TYP | MAX | UNIT |
|------|---|---|--------|-----|-----|-----|------|
| LCD Timing | DCLK | Frequency | $f_{CLK}$ | 45 | 54 | 70 | MHz |
| | | Period | $t_{CLK}$ | 14.3 | 18.5 | 22.2 | ns |
| | DENA | Horizontal Active Time | $t_{HA}$ | 640 | 640 | 640 | $t_{CLK}$ |
| | | Horizontal Blank Time | $t_{HB}$ | 45 | 204 | 390 | $t_{CLK}$ |
| | | Horizontal Total Time | $t_H$ | 685 | 844 | 1030 | $t_{CLK}$ |
| | | Vertical Active Time | $t_{VA}$ | 1024 | 1024 | 1024 | $t_H$ |
| | | Vertical Blank Time | $t_{VB}$ | 12 | 42 | 376 | $t_H$ |
| | | Vertical Total Time | $t_V$ | 1036 | 1066 | 1400 | $t_H$ |
| | | Vertical Frame Rate | Fr | 50 | 60 | 75 | Hz |

[Note]
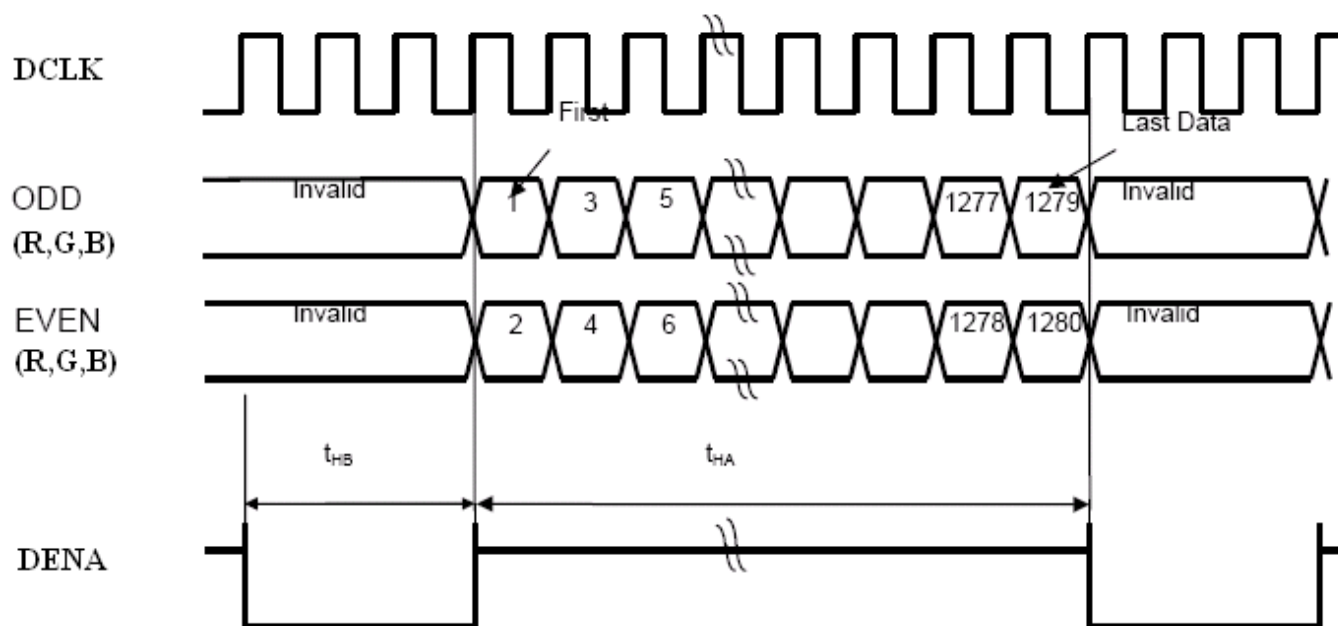
1) DENA should always be positive polarity as shown in the timing specification.

2) DCLK should exist during all blanking period.

3) LVDS IC or compatible

| Receiver | Transmitter |
|----------|-------------|
| DS90C384MTD(NS) | DS90C383MTD(NS) |
| SN75LVDS82(TI) | SN75LVDS83(TI) |

4) Pin assignment for FlatLink transmitter SN75LVDS83(TI)

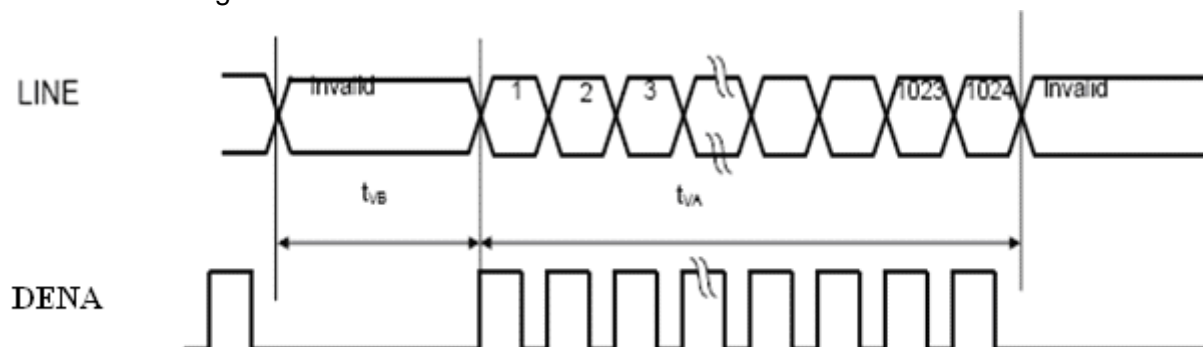| Pin No. | Pin Name | Require Signal | Pin No. | Pin Name | Require Signal |
|---------|----------|----------------|---------|----------|----------------|
| 1 | VCC | Power Supply for TTL Input | 29 | GND | Ground pin for TTL |
| 2 | D5 | TTL Input (R7) | 30 | D26 | TTL Input(DE) |
| 3 | D6 | TTL Input (R5) | 31 | TxCLKIN | TTL Level clock Input |
| 4 | D7 | TTL Input (G0) | 32 | PWR DWN | Power Down Input |
| 5 | GND | Ground pin for TTL | 33 | PLL GND | Ground pin for PLL |
| 6 | D8 | TTL Input (G1) | 34 | PLL VCC | Power Supply for PLL |
| 7 | D9 | TTL Input (G2) | 35 | PLL GND | Ground pin for PLL |
| 8 | D10 | TTL Input (G6) | 36 | LVDS GND | Ground pin for LVDS |
| 9 | VCC | Power Supply for TTL Input | 37 | TxOUT3+ | Positive LVDS differential data output 3 |
| 10 | D11 | TTL Input (G7) | 38 | TxOUT3- | Negative LVDS differential data output 3 |
| 11 | D12 | TTL Input (G3) | 39 | TxCLKOUT+ | Positive LVDS differential clock output |
| 12 | D13 | TTL Input (G4) | 40 | TxCLKOUT- | Negative LVDS differential clock output |
| 13 | GND | Ground pin for TTL | 41 | TxOUT2+ | Positive LDVS differential data output 2 |
| 14 | D14 | TTL Input (G5) | 42 | TxOUT2- | Negative LVDS differential data output 2 |
| 15 | D15 | TTL Input (B0) | 43 | LVDS GND | Ground pin for LVDS |
| 16 | D16 | TTL Input (B6) | 44 | LVDS VCC | Power Supply for LVDS |
| 17 | VCC | Power Supply for TTL Input | 45 | TxOUT1+ | Positive LVDS differential data output 1 |
| 18 | D17 | TTL Input (B7) | 46 | TxOUT1- | Negative LVDS differential data output 1 |
| 19 | D18 | TTL Input (B1) | 47 | TxOUT0+ | Positive LVDS differential data output 0 |
| 20 | D19 | TTL Input (B2) | 48 | TxOUT0- | Negative LVDS differential data output 0 |
| 21 | GND | Ground pin for TTL | 49 | LVDS GND | Ground pin for TTL |
| 22 | D20 | TTL Input (B3) | 50 | D27 | TTL Input (R6) |
| 23 | D21 | TTL Input (B4) | 51 | D0 | TTL Input (R0) |
| 24 | D22 | TTL Input (B5) | 52 | D1 | TTL Input (R1) |
| 25 | D23 | TTL Input (LVDS) | 53 | GND | Ground pin for TTL |
| 26 | VCC | Power Supply for TTL Input | 54 | D2 | TTL Input (R2) |
| 27 | D24 | TTL Input (HSYNC) | 55 | D3 | TTL Input (R3) |
| 28 | D25 | TTL Input (VSYNC) | 56 | D4 | TTL Input (R4) |

(2) Timing
Chart

DCLK

ODD
(R,G,B)

First    Invalid   1   3   5 ... 1277 1279   Invalid    Last Data

EVEN
(R,G,B)

Invalid   2   4   6 ... 1278 1280   Invalid

$t_{HB}$          $t_{HA}$

DENA

a. Horizontal Timing

b. Vertical Timing

LINE

Invalid   1   2   3 ... 1023 1024   Invalid

$t_{VB}$          $t_{VA}$

DENA

(3) LVDS DATA MAPPING

DCLK  —  1 t_CLK

RXx0+/- : R[1] | R[0] | G[0] | R[5] | R[4] | R[3] | R[2] | R[1] | R[0]

RXx1+/- : G[2] | G[1] | B[1] | B[0] | G[5] | G[4] | G[3] | G[2] | G[1]

RXx2+/- : B[3] | B[2] | DE | VSYNC | HSYNC | B[5] | B[4] | B[3] | B[2]

RXx3+/- : R[7] | R[6] | | B[7] | B[6] | G[7] | G[6] | R[7] | R[6]

DATA for current CLK cycle                        NEXT
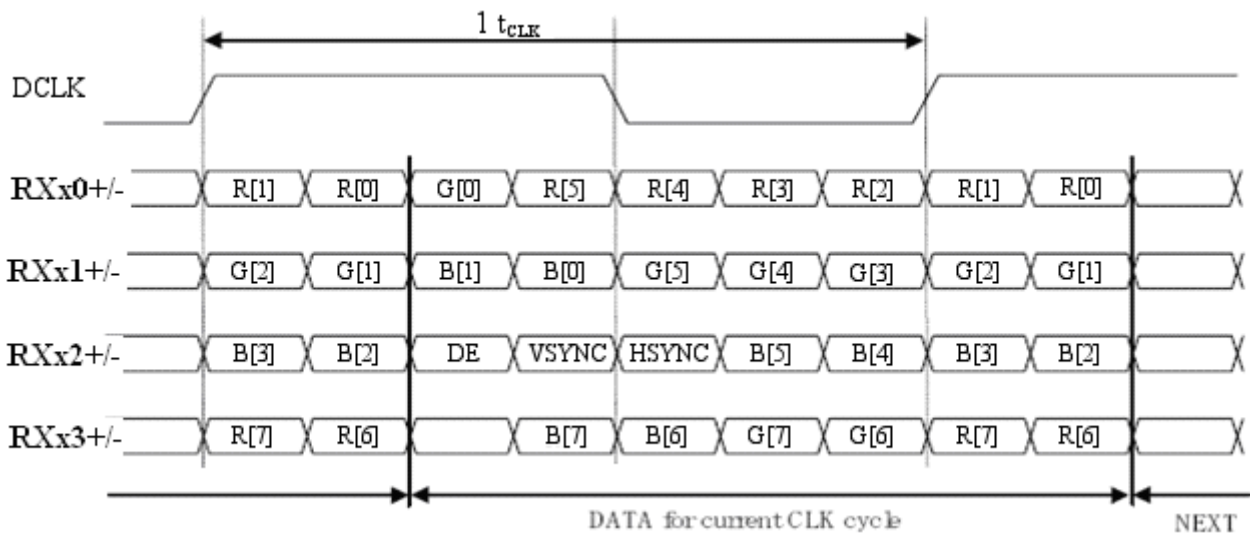
(4) Color Data Assignment

| COLOR | INPUT DATA | R DATA | | | | | | | | G DATA | | | | | | | | B DATA | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R[7] MSB | R[6] | R[5] | R[4] | R[3] | R[2] | R[1] | R[0] LSB | G[7] MSB | G[6] | G[5] | G[4] | G[3] | G[2] | G[1] | G[0] LSB | B[7] MSB | B[6] | B[5] | B[4] | B[3] | B[2] | B[1] | B[0] 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 |

[Note]

1) Definition of gray scale Color (n): n indicates gray scale level.
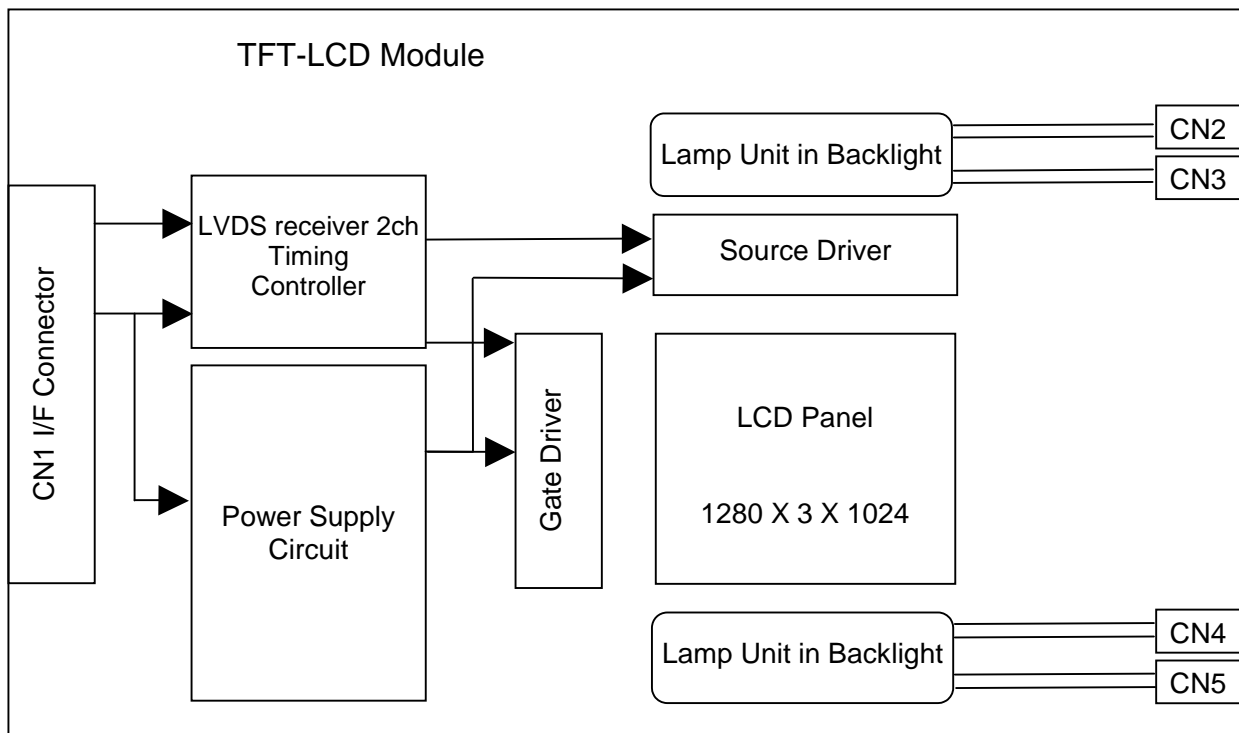
   Higher n means brighter level.

2) Data: 1-High, 0-Low.

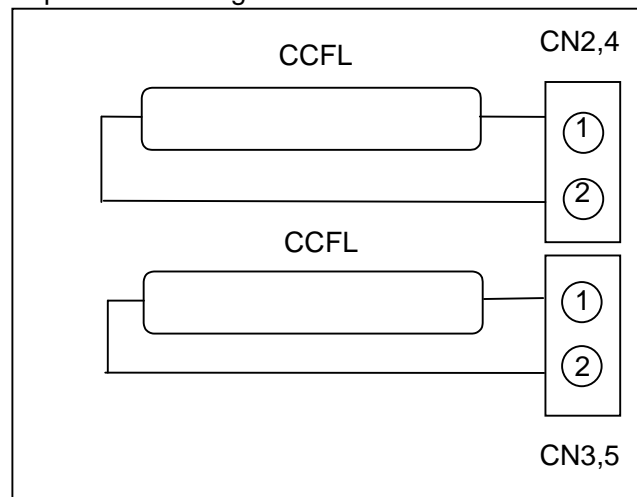3) This assignment is applied to both odd and even data.

(5) Color Data Assignment

| D(1,1) | D(2,1) | -- | D(X,1) | -- | D(1279,1) | D(1280,1) |
|---|---|---|---|---|---|---|
| D(1,2) | D(2,2) | -- | D(X,2) | -- | D(1279,2) | D(1280,2) |
| \| | \| | + | .. | + | \| | \| |
| D(1,Y) | D(2,Y) | -- | D(X,Y) | -- | D(1279,Y) | D(1280,Y) |
| \| | \| | + | .. | + | \| | \| |
| D(1,1023) | D(2, 1023) | -- | D(X, 1023) | -- | D(1279,1023) | D(1280,1023) |
| D(1,1024) | D(2, 1024) | -- | D(X, 1024) | -- | D(1279,1024) | D(1280,1024) |

# 6. BLOCK DIAGRAM



TFT-LCD Module

CN1 I/F Connector

LVDS receiver 2ch Timing Controller

Power Supply Circuit

Gate Driver

Lamp Unit in Backlight

Source Driver

LCD Panel

1280 X 3 X 1024

Lamp Unit in Backlight

CN2

CN3

CN4

CN5

Lamp Uint in Backlight

CCFL

CN2,4

① ②

CCFL

① ②

CN3,5

# 7. MECHANICAL SPECIFICATION

(1) Front side (Tolerance is ±0.5mm unless noted)                              Unit: mm



(2) Rear side (Tolerance is ±0.5mm unless noted)

Unit: mm

# 8. OPTICAL CHARACTERISTICS

Ta=25℃，VCC=5.0V

| ITEM | | SYMBOL | CONDITION | min | typ | max | UNIT | REMARK |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | θ=ψ= 0° | 800 | 1000 | -- | -- | *1) 2) |
| Luminance(CEN) | | L | θ=ψ= 0° | 200 | 250 | -- | cd/m$^2$ | *1) 3) |
| 9P Uniformity | | ΔL | θ=ψ= 0° | 75 | -- | -- | % | *1) 3) |
| Response Time | Tr | θ=ψ= 0° | | 5 | 10 | ms | *5) |
| | Tf | θ=ψ= 0° | | | | | |
| Crosstalk | | CT | θ=ψ= 0° | 0 | -- | 1.5 | % | *6) |
| Viewing Angle | Horizontal | ψ | CR≧10 | 150 | 170 | -- | -- | *4) |
| | Vertical | θ | | 140 | 160 | -- | -- | |
| Color Coordinates | White | X Y | θ=ψ= 0° | 0.283 0.299 | 0.313 0.329 | 0.343 0.359 | Color Coordinates | *3) |
| | Red | X Y | | 0.617 0.307 | 0.647 0.337 | 0.677 0.367 | | |
| | Green | X Y | | 0.250 0.586 | 0.280 0.616 | 0.310 0.646 | | |
| | Blue | X Y | | 0.120 0.045 | 0.150 0.075 | 0.180 0.105 | | |
| Gamut | | CG | θ=ψ= 0° | 70 | 72 | -- | % | -- |
| Gamma | | γ | VESA | 2.0 | 2.2 | 2.4 | -- | *7) |

[Note]

All optical specification condition:

(1) Equipment: Color coordinate and color gamut are measured by CS-1000, and all the other items are measured by BM-5A (TOPCON).

(2) Condition: IL=8 (each lamp) mA, Inverter: CVT (SIT-22FA3), Frequency=50 kHz.

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.
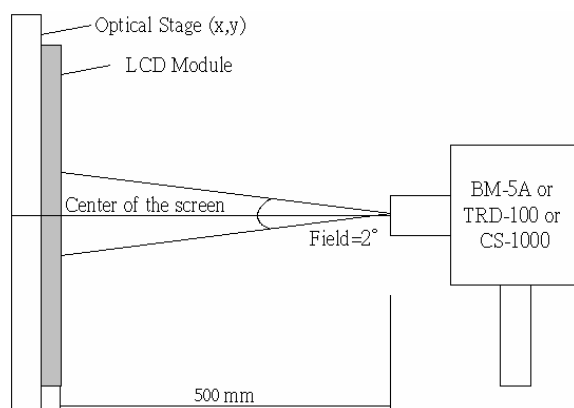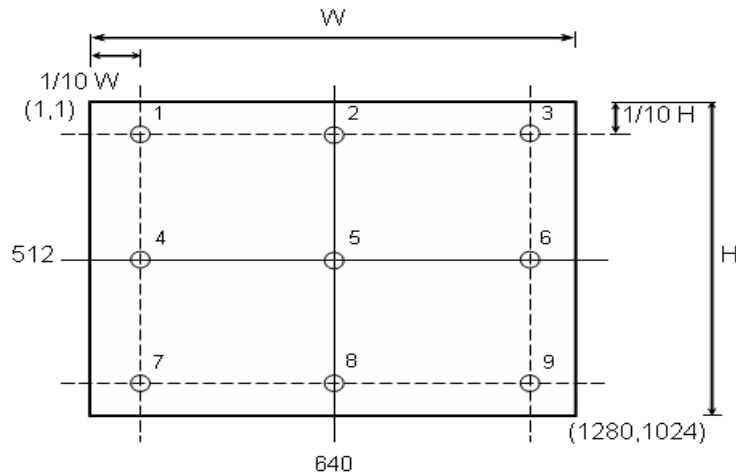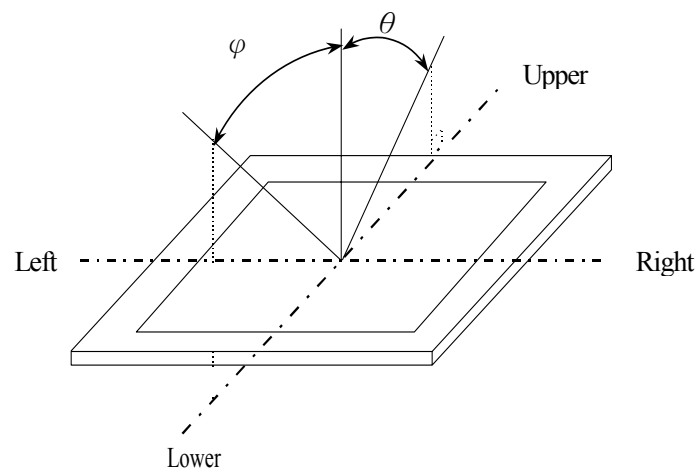
1).Definition of Contrast Ratio:

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


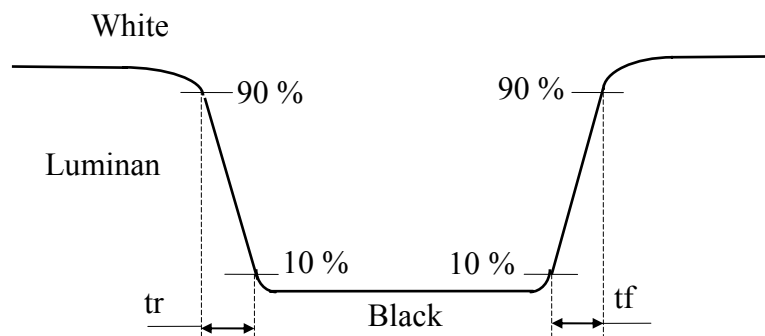2).Definition of Luminance and Luminance uniformity:

      Center Luminance: measuring the luminance of the point no. 5

      Average Luminance: measuring average luminance of points no.1-no.9


      Uniformity: ΔL= [L (Min)/L (Max)] ×100 %



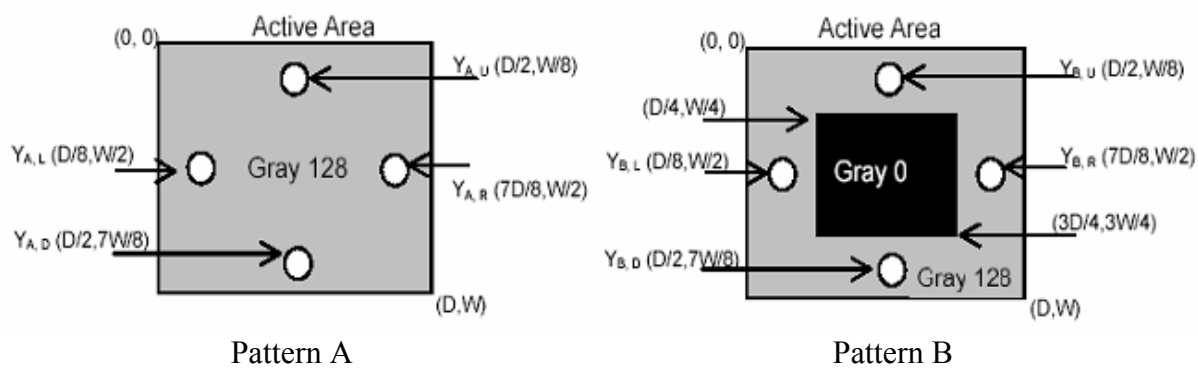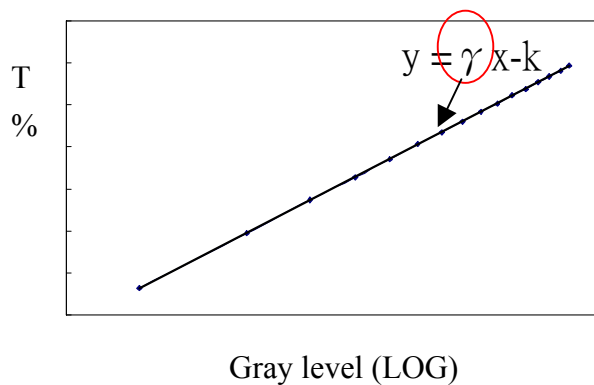3).Definition of Viewing Angle (θ,ψ):



*4) Definition of Response Time:

5) Definition of crosstalk:

$CT = |Y_B - Y_A| / Y_A \times 100$ (%)

$Y_A$ : The luminance of measured position at pattern A

$Y_B$ : The luminance of measured position at pattern B with Gray level 0



Pattern A                                      Pattern B

6) Definition of Gamma (γ), follow VESA standard sampling every 16 gray level (0,16,32,…..224,240,255)



Gray level (LOG)

# 9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

| TEST ITEMS | CONDITIONS |
|---|---|
| HIGH TEMPERATURE HIGH HUMIDITY OPERATION | 50℃; 90%RH; 240h (No condensation) |
| HIGH TEMPERATURE HIGH HUMIDITY STORAGE | 60℃; 90%RH;48h (No condensation) |
| HIGH TEMPERATURE OPERATION | 50℃; 240h |
| HIGH TEMPERATURE STORAGE | 60℃; 240h |
| LOW TEMPERATURE OPERATION | 0℃; 240h |
| LOW TEMPERATURE STORAGE | -20℃; 240h |
| THERMAL SHOCK | BETWEEN -20℃(1hr)AND 60℃(1hr); 100 CYCLES |

(2) Shock & Vibration

| ITEMS | CONDITIONS |
|---|---|
| SHOCK (NON-OPERATION) | Shock level:1470m/s^2(150G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs |
| VIBRATION (NON-OPERATION) | Vibration level: 12.25m/s^2(1.25G) zero to peak Waveform: sinusoidal Frequency range: 5 to 500 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 5 to 500Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours) |

(3) ESD

| POSITION | CONDITION( MDL turn off) |
|---|---|
| Connector | 1. 200 pF，0 Ω，±250 V 2. contact mode for each pin |
| Module | 1.  150 pF，330 Ω，±15K V 2.  Air mode, test 25 times for each test point 3.  Contact mode, 25 times for each test point |

(4) Low Pressure test

| TEST ITEM | CONDITION |
|---|---|
| Low Pressure test(storage) | 260HPa (30000 ft.)；24 Hr |

(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;

## (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 guide lines.

a) 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.

b) 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.

c) 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.

d) 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.

e) 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 cloth 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 wit inverter.

## (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 charge 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.

## (3) PRECAUTFONSWITHELECTROSTATICS

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.

## (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 -$20℃$.

## (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 thoroughly with soap and water.

**(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:

a) 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.

b) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.

c) Please handle packaging box with care not to give them sudden shock and vibrations.   And also please do not throw them up.

d) 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.)