# Crystal Clear Technology

# Product Specification

## T1210X01X00

(REVISION 3)

Crystal Clear Technology sdn. bhd.
16 Jalan TP5, Taman Perindustrian Sime UEP,
47600 Subang Jaya, Selangor DE
Malaysia.
T: +603 80247099 F: +603 80247

## 1.0 TABLE OF CONTENTS


| NO | ITEM | PAGE |
|---|---|---|
| 1 | TABLE OF CONTENTS | 2 |
| 2 | RECORD OF REVISION | 3 |
| 3 | GENERAL DESCRIPTION | 4 ~ 5 |
| 4 | ELECTRICAL SEPCIFICATIONS | 6 ~ 11 |
| 5 | SIGNAL TIMING SECIFICATION | 12 ~ 14 |
| 6 | INTERFACE CONNECTION | 15 ~ 16 |
| 7 | OPTICAL SPECIFICATIONS | 17 ~ 19 |
| 8 | MECHAICAL CHARACTERITICS | 20 ~ 21 |
| 9 | RELIABILITY TEST | 22 |
| 10 | HANDLING & CAUTIONS | 23 ~ 25 |
| | | |
| | | |

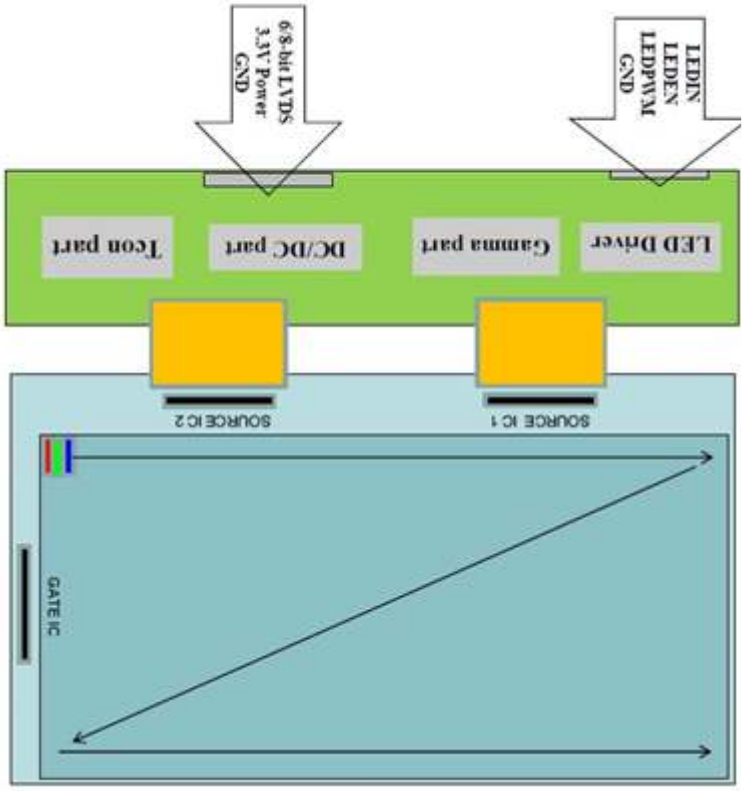
## 2.0 RECORD OF REVISION

| REV | DATE | ITEM | page | Release by |
|---|---|---|---|---|
| 1 | 15/11/15 | Initial Release | | Azhar |
| 2 | 28/01/16 | Change model name T1210T01W00 to T1210X01X00 | | Azhar |
| 3 | 23/08/17 | Change model name T1210X01X00 to T1210T01N00 | | Azhar |

# 3.0 GENERAL DESCRIPTION

## 3.1 Introduction

T1210T01N00 is a colour active matrix TFT-LCD panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This model is composed of a TFT-LCD Panel, a driving circuit and a backlight system. It is transmissive type display operating in the normal white. This TFT-LCD has a 12.1 inch diagonally measured active area with SVGA resolutions (800 horizontal by 600 vertical array). Each pixel is divided into Red, Green and Blue dots which arranged in vertical stripe and this pane can display 16.7M (RGB 8-Bits).




## 3.2 Features

- 0.5t Glass (single)
- This and light weight
- High Luminance and contrast ration, low reflection and wire viewing angle
- Module Design
- RoHS Compliant

## 3.3 Application

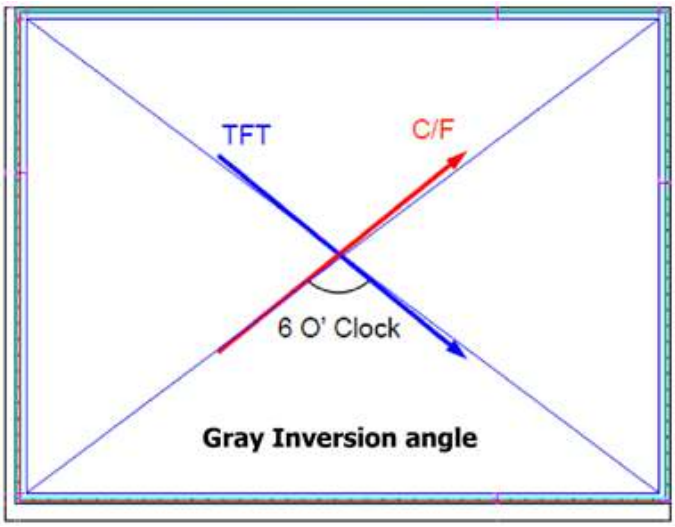
- Medical & Industrial Application

## 3.4 General Specification

| Parameter | Specification | Unit | Remark |
|---|---|---|---|
| Active Area | 246.0(H) x 184.5 (V) | Mm | |
| Number of Pixels | 800(H)RGB x 600(V) | Pixels | |
| Pixel Pitch | 0.3075(H) x 0.3075(V) | Mm | |
| Pixel Arrangement | RGB Vertical Stripe | | |
| Display Colors | 16.7M | Colors | |
| Display Mode | 55% (typ) | | |
| Dimensional Outline | Normally White, Transmissive mode | | |
| Viewing Direction | 279 (H) x 209(V) x 9(D) | Mm | Module |
| Driver IC | HX8245-C01 / HX8677-G<br>T-con: HX8841 | | Note1, 2 |
| Weight | TBD | gm | |

Note:

1. The biggest CR Direction : 6 O'clock, the worst Grey Inversion Direction : 6 O'clock
2. The TFT and CF Rubbing Direction



# 4.0 ELECTRICAL SEPCIFICATIONS

## 4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on table as follows. When used out of the absolute maximum ratings, the LSI may be permanently damaged. Using LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristics conditions are exceeded during normal operation, the LSY will malfunction and cause poor reliability.

Source IC ---HX8245-C

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Power Supply voltage | AVDD | 14.85 | V |
| Driver supply voltage | VDD | 3.96 | V |
| Input voltage | Vr1~Vr18 | AVDD+0.3 | V |
| | Others | 0.6AVDD | V |
| Operating temperature range | TOPR | -30~85 | ℃ |
| Storage Temperature range | TSTG | -55~125 | ℃ |

Gate IC --- HX8677-G

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Power supply voltage1 | VDD | 7.0 | V |
| Power supply voltage1 | VGH | 42.0 | V |
| Power supply voltage3 | VGH-42 | VGH-42 | V |
| Power supply voltage4 | VGH-VGL | 42.0 | V |
| Operating temperature range | TOPR | -40~95 | ℃ |
| Storage Temperature range | TSTG | -55~125 | ℃ |

Tcon IC --- HX8841

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Supply voltage | VDD | 3.6 | V |
| CMOS/TTL input voltage | Vin | 3.6 | V |
| CMOS/TTL input voltage | Vout | 3.6 | V |
| LVDS receiver input voltage | Vin | 3.6 | V |
| Operating temperature range | TOPR | -40~95 | ℃ |
| Storage Temperature range | TSTG | -55~125 | ℃ |

Note:
If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute ratings, therefore specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

## 4.2 DC Characteristic

Source IC --- HX8245-C

(For the analog circuit)

| Parameter | Symbol | Spec. Min. | Spec. Typ. | Spec. Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Supply Voltage | AVDD | 6.5 | 8.4 | 13.5 | V | For the analog circuit power |
| Input Level of $V_{γ1}$ ~ $V_{γ7}$ | $V_{REF}$ | 0.4AVDD | - | AVDD-0.1 | V | Gamma correction voltage |
| Input Level of $V_{γ8}$ ~ $V_{γ14}$ | $V_{REF}$ | 0.1 | - | 0.6AVDD | V | Gamma correction voltage |
| Output Voltage Deviation | $V_{OD}$ | - | - | ±20 | mV | - |
| Voltage Output Offset between Chips | $V_{OC}$ | - | - | ±15 | mV | - |
| Dynamic Range of Output | $V_{DR}$ | 0.1 | - | AVDD-0.1 | V | OUT1~OUT1200/1026 |
| Sinking Current of Outputs | $I_{OL}$ | - | \|-80\| | - | μA | OUT1~OUT1200/1026; AVDD=10V Vo=0.1V v.s 1.0V |
| Driving Current of Outputs | $I_{OH}$ | - | \|80\| | - | μA | OUT1~OUT1200/1026; AVDD=10V Vo=9.9V v.s 9.0V |
| Impedance of Gamma Correction | $R_I$ | 0.8Rn | 1.1Rn | 1.4Rn | Ω | Rn: Internal gamma resistor |
| Analog Stand-by Current | $I_{SC}$ | - | 3.7 | - | mA | No load, AVDD=8.4V and all operating is stopped |
| Analog Operating Current | $I_{OC}$ | - | 19 | - | mA | $F_{CLK}$=40MHz $F_{LD}$=50KHz AVDD=8.4V $V_{γ1}$=8V $V_{γ14}$=0.4V in black pattern |

**Table 6. 3 DC electrical characteristics of analog circuit**

Gate IC --- HX8677-G

| Parameter | Symbol | Applicable pin | Condition | Spec. | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Input H voltage | $V_{IH}$ | All input pins | - | 0.7VDD | - | VDD | V |
| Input L voltage | $V_{IL}$ | All input pins | - | VSS | - | 0.3VDD | |
| Output H voltage | $V_{OH}$ | STV1,2 | $I_{OH}$=40μA | VDD-0.4 | - | VDD | |
| Output L voltage | $V_{OL}$ | STV1,2 | $I_{OL}$=40μA | VSS | - | VSS+0.4 | |
| Output H resistance | $R_{OH}$ | OUT1 ~ OUT600 | $V_{OUT}$= VGH-0.5V | - | - | 1000 | Ω |
| Output L resistance | $R_{OL}$ | OUT1 ~ OUT600 | $V_{OUT}$= VGL+0.5V | - | - | 1000 | Ω |
| Input leakage current | $I_{IN}$ | Note(1) | - | -1.0 | - | +1.0 | μA |
| Pull high resistance1 | $R_{PU}$ | /XAO | $V_{IN}$=VSS | 40 | - | 200 | kΩ |
| Pull high resistance2 | $R_{PU}$ | Note(2) | VDD=3.3V, $T_A$=25℃ | 70 | 200 | 400 | kΩ |
| Pull low resistance | $R_{PD}$ | Note(3) | VDD=3.3V, $T_A$=25℃ | 70 | 200 | 400 | kΩ |
| Power off reset threshold voltage | $V_{POFF}$ | - | - | - | 1.6 | - | V |
| VGH Power consumption | $I_{VGH}$ | VGH | Note(4) | - | - | 200 | μA |
| VDD Power consumption | $I_{VDD}$ | VDD | | - | - | 100 | |

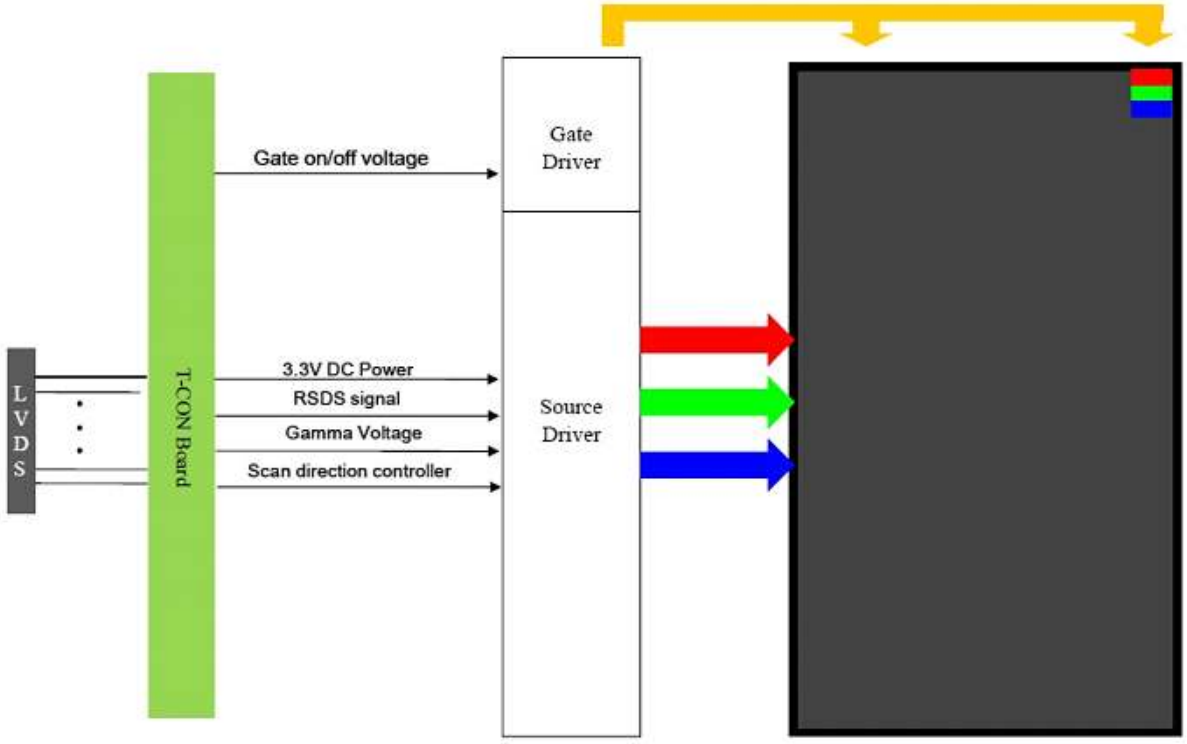
Note: (1) All input except /XAO, MODE1, MODE2, SEG1, SEG2, EVEN
(2) MODE1, MODE2
(3) SEG1, SEG2, EVEN
(4) Power consumption in the following condition:
Output no load, VGH = 20V, VGL = -8V, VDD = 3.0V,
$V_{IH}$ = VDD. $V_{IL}$ = VSS, $F_{CPV}$ = 50KHz, SEG1 = SEG2 = EVEN = OE1 = OE2 =OE3 = $V_{IL}$: MODE1 = MODE2 = /XAO = $V_{IH}$

4.3 Backlight Driving Conditions

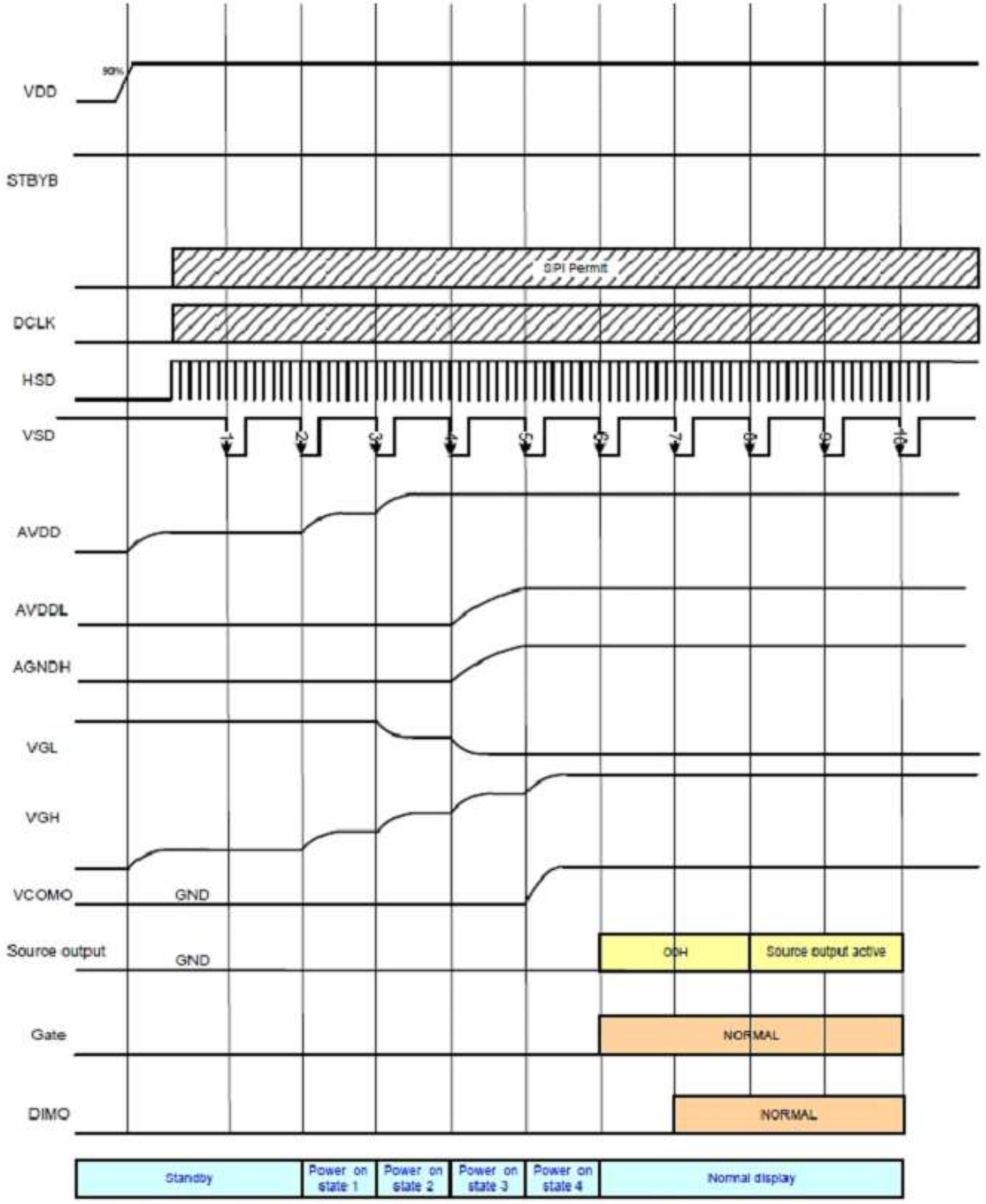
| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| LED Forward Voltage | $V_F$ | 2.9 | - | 3.4 | V | - |
| LED Forward Current | $I_F$ | - | 20 | - | mA | - |
| LED Power Consumption | $P_{LED}$ | - | 2.448 | - | W | Note 1 |
| LED Life-Time | N/A | | (30,000) | | Hrs | IF = 20mA Note 2 |

Note:
1. Calculator Value for reference $I_{LED}$ x $V_{LED}$ x LED Quantity = $P_{LED}$
2. The LED Life-time define as the estimated time to 50% degradation of initial Luminous

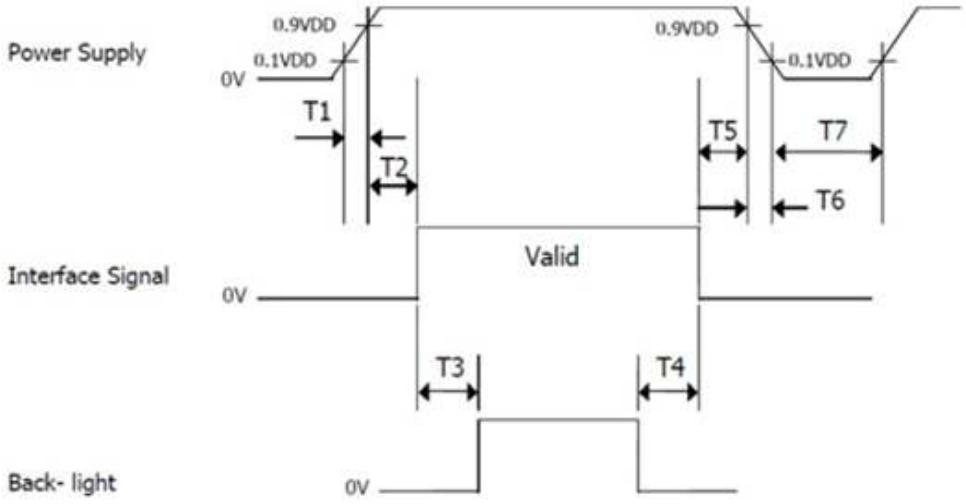
## 4.4 Block Diagram



## 4.5 Input Signals, Basic Display colours and Grey Scale of colours



## 4.6 Power Sequence




| Parameter | Values | | | Units |
|---|---|---|---|---|
| | Min | Typ | Max | |
| T1 | 0.5 | - | 10 | ms |
| T2 | 0 | - | 50 | ms |
| T3 | 200 | - | - | ms |
| T4 | 200 | - | - | ms |
| T5 | 0.5 | - | 50 | ms |
| T6 | 0 | - | 10 | ms |
| T7 | 500 | - | - | ms |

## 5.0 SIGNAL TIMING SPECIFICATION

### 5.1 The T1040T01W00 is operated by the DE only

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| DCLK Frequency | fclk | 32.6 | 39.6 | 62.4 | MHz |
| Horizontal Display Area | thd | | 800 | | DCLK |
| HSD Period | th | 900 | 1056 | 1300 | DCLK |
| HSD Blanking | thb + thfp | 90 | 200 | 500 | DCLK |
| Vertical Display Area | tvd | | 600 | | TH |
| VSD Period | tv | 610 | 630 | 800 | TH |
| VSD Blanking | tvbp + tvfp | 10 | 30 | 200 | TH |

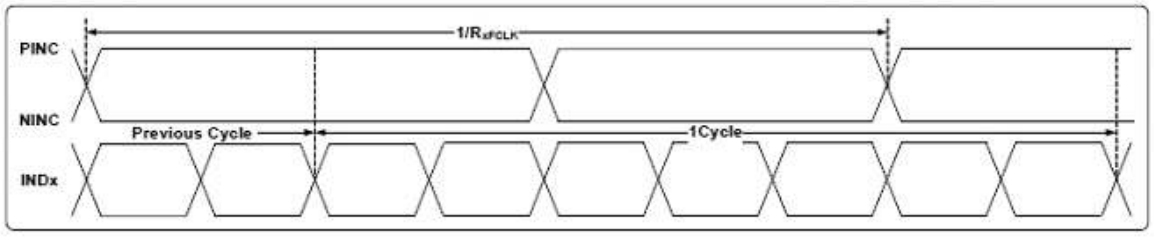
DE mode (800 x 600)

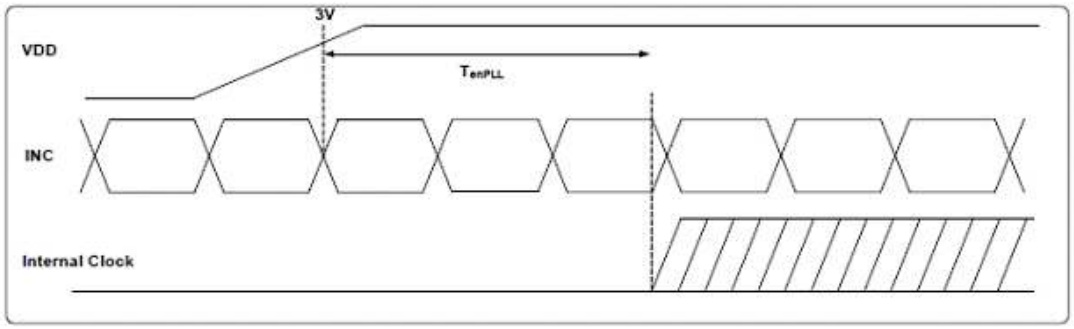
### 5.2 LVDS Rx Interface Timing Parameter

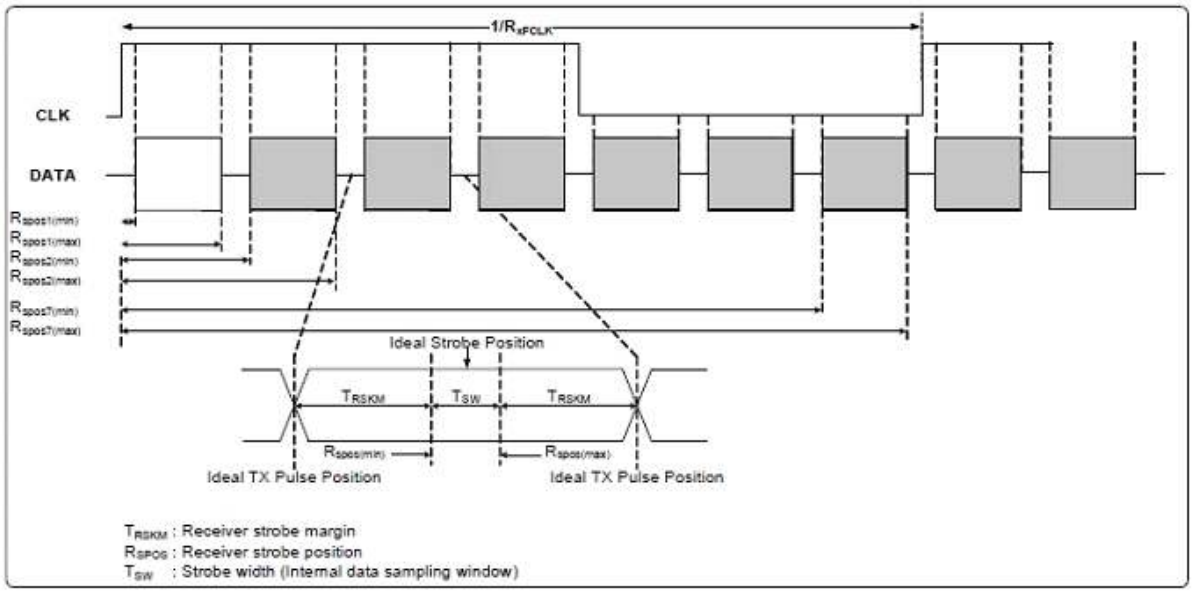
The Specification of the LVDS Rx Interface timing parameter is shown below.

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Clock frequency | RXFCLK | 20 | - | 85 | MHz | - |
| Input data skew margin | TRSKM | -600 | - | +600 | pS | \| VID \| =200mV<br>RXVCM =1.2V<br>RXFCLK =65MHz |
| Clock high time | TLVCH | - | 4/(7* RXFCLK) | - | ns | - |
| Clock low time | TLVCL | - | 3/(7* RXFCLK) | - | ns | - |
| PLL wake-up time | TemPLL | - | - | 150 | μs | - |

LVDS mode AD electrical Characteristics

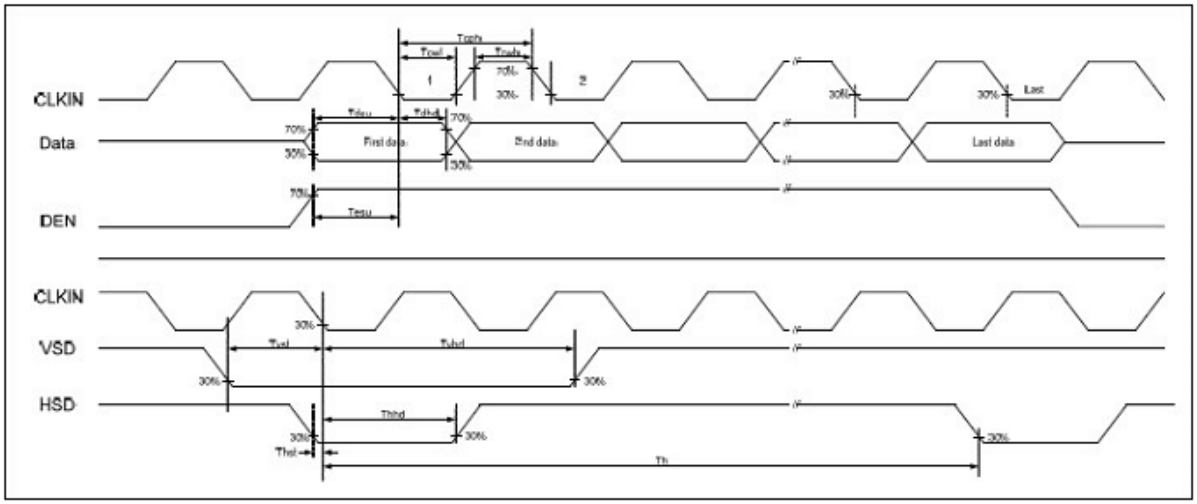


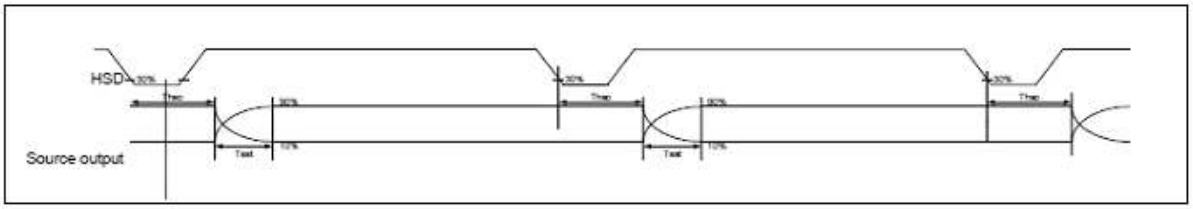



## 5.3 Signal Timing Waveforms of Interface Signal

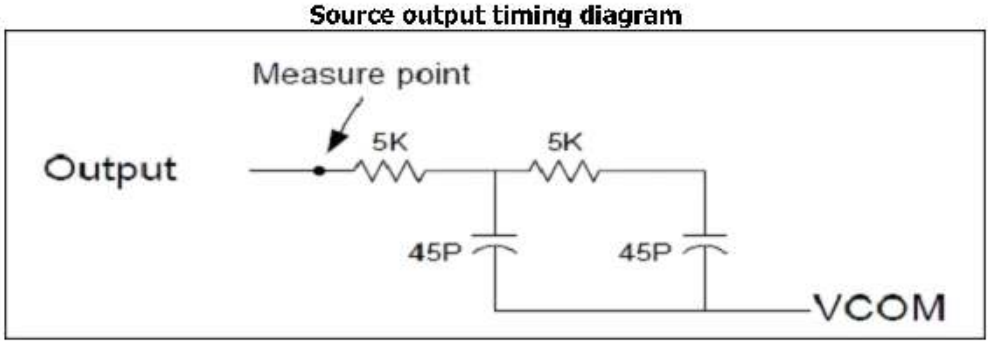
a. Input Clock and Data Timing Interface Diagram




b. Source Output Timing Diagram




**Source output timing diagram**




Output load condition

## 6.0 INTERFACE CONNECTION

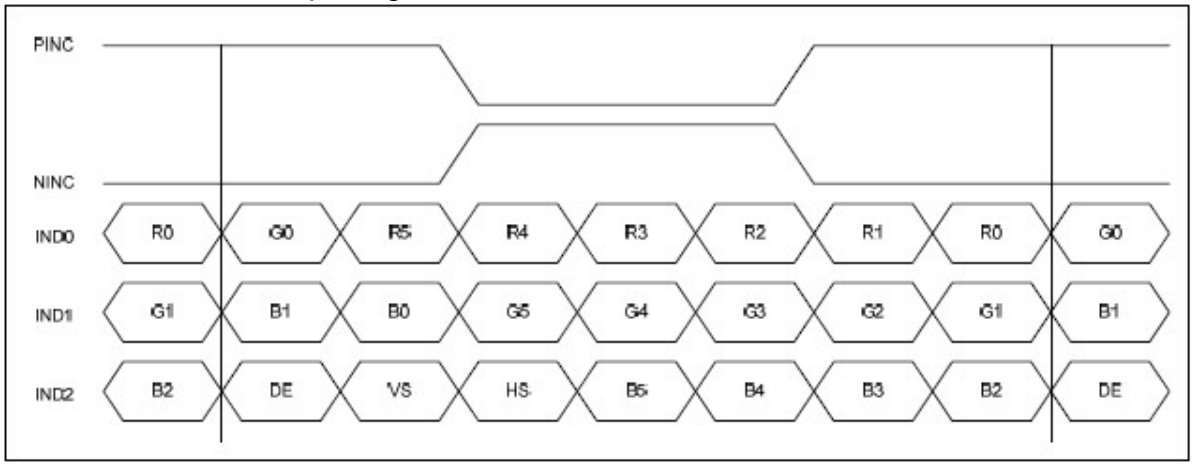
### 6.1 Electrical Interface Connection

The electronics interface connector is STM MSB24013P20 or compatible. The connector interface pin assignments are listed below.

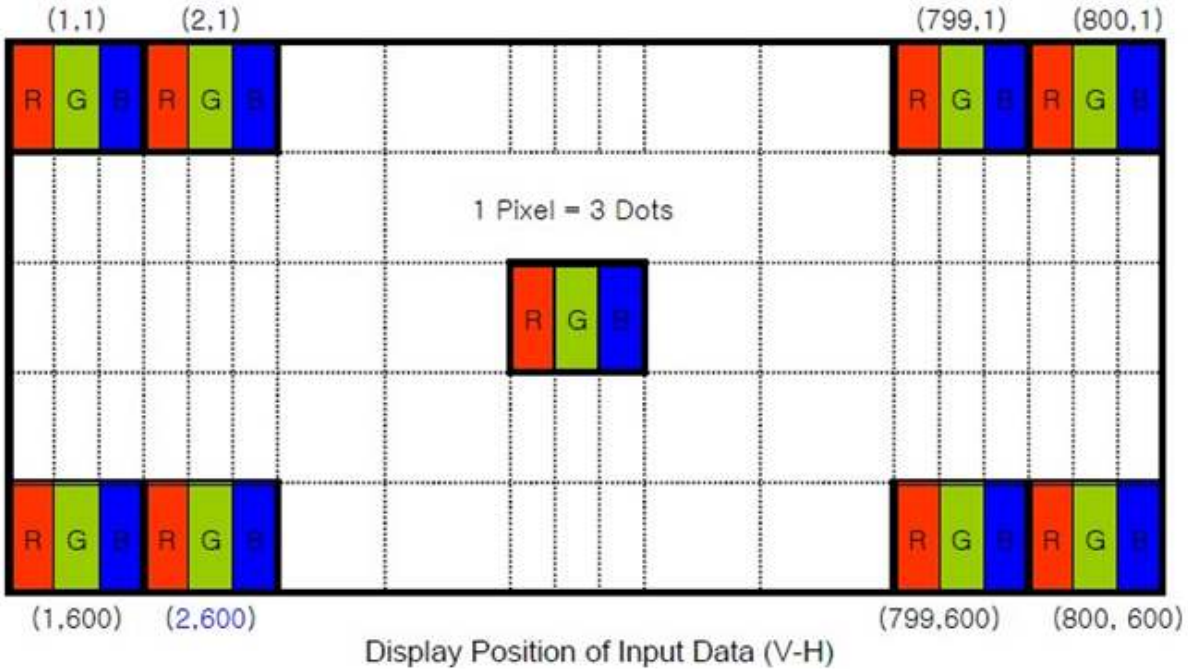
| Pin | Symbol | Function |
|---|---|---|
| 1 | VDD | Logic Power 3.3V (Panel logic) |
| 2 | VDD | Logic Power 3.3V (Panel logic) |
| 3 | GND | Ground |
| 4 | GND | Ground |
| 5 | IN0- | LVDS receiver negative signal channel 0 |
| 6 | IN0+ | LVDS receiver positive signal channel 0 |
| 7 | GND | Ground |
| 8 | IN1- | LVDS receiver negative signal channel 1 |
| 9 | IN1+ | LVDS receiver positive signal channel 1 |
| 10 | GND | Ground |
| 11 | IN2- | LVDS receiver negative signal channel 2 |
| 12 | IN2+ | LVDS receiver positive signal channel 2 |
| 13 | GND | Ground |
| 14 | CLK- | LVDS receiver negative signal clock |
| 15 | CLK+ | LVDS receiver positive signal clock |
| 16 | GND | Ground |
| 17 | IN3- | LVDS receiver negative signal channel 3 (NC for 6bit LVDS input) |
| 18 | IN3+ | LVDS receiver positive signal channel 3 (NC for 6bit LVDS input) |
| 19 | GND | Ground |
| 20 | SEL68 | 6/8bits LVDS data input selection [H：8bit L/NC：6bit] |

Note1: High Stands for “2.7 — 3.3”, Low stands for “0 -- 0.4”

### 6.2 LVDS input signal



## 6.3 Data Input Format




Display Position of Input Data (V-H)

## 7.0 OPTICAL SPECIFICATIONS

### 7.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance≤ 1 lux and temperature = 25±2°C) with the equipment of Luminance meter system (Topcon SR-UL1R and Westar TRD-100A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°.The centre of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement. Optimum viewing angle direction is 12 o'clock.

### 7.2 Optical Specifications

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Threshold Voltage | | Vsat | | 2.0 | 2.2 | 2.4 | V | Fig.1 |
| | | Vth | | 1.1 | 1.3 | 1.5 | V | |
| Viewing Angle | Horizontal | Θ3 | CR>10 | 60 | 70 | | ° | Note 1 |
| | | Θ9 | | 60 | 70 | | ° | |
| | Vertical | Θ12 | | 50 | 60 | | ° | |
| | | Θ6 | | 60 | 70 | | ° | |
| Contrast Ratio | | CR | Θ= 0° | 300 | 400 | | | Note 2 |
| Luminance | | cd/m2 | Θ= 0° | 350 | 400 | | lm | Note 3 |
| Uniformity | | % | Θ= 0° | 70% | 80% | | | Note 4 |
| NTSC | | % | Θ= 0° | | 50% | | | |
| Reproduction Of color | Red | Rx | Θ= 0° | | TBD | | | Note 5 *Module |
| | | Ry | | | TBD | | | |
| | Green | Gx | | | TBD | | | |
| | | Gy | | | TBD | | | |
| | Blue | Bx | | | TBD | | | |
| | | By | | | TBD | | | |
| White | | Wx | Θ= 0° | | TBD | | | |
| | | Wy | | | TBD | | | |
| Response Time | | Tr+Tf | Θ= 0° | | 25 | | ms | Note 6 |

**Note:**

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).
2. Contrast measurements shall be made at viewing angle of Θ= 0· and at the centre of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. This measurement shall be taken at the locations shown in FIG. 2.

4. Uniformity measurement shall be taken at the locations shown in FIG . 2&3, for a total of the measurements per display, measure surface luminance of these nine points across the LCD surface 50cm from the surface with all pixels displaying white.

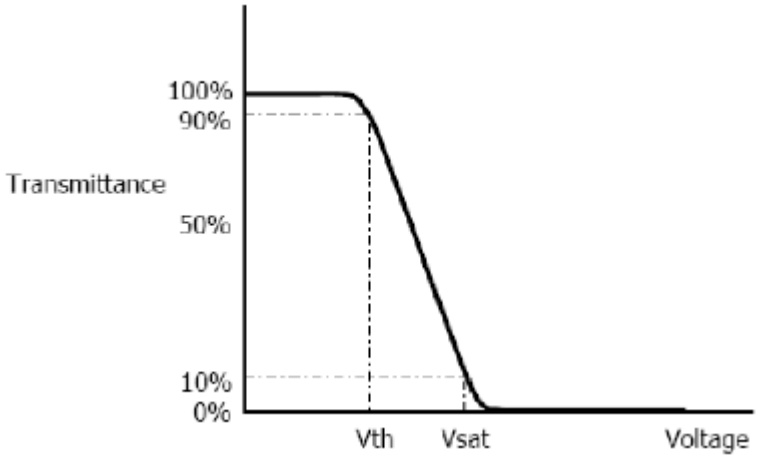
$$\text{Uniformity} = \frac{\text{Min Luminance of 9 points}}{\text{Max Luminance of 9 points}} \times 100\%$$

5. The color chromaticity coordinates specified in Table1 shall be calculated from The spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the Module.

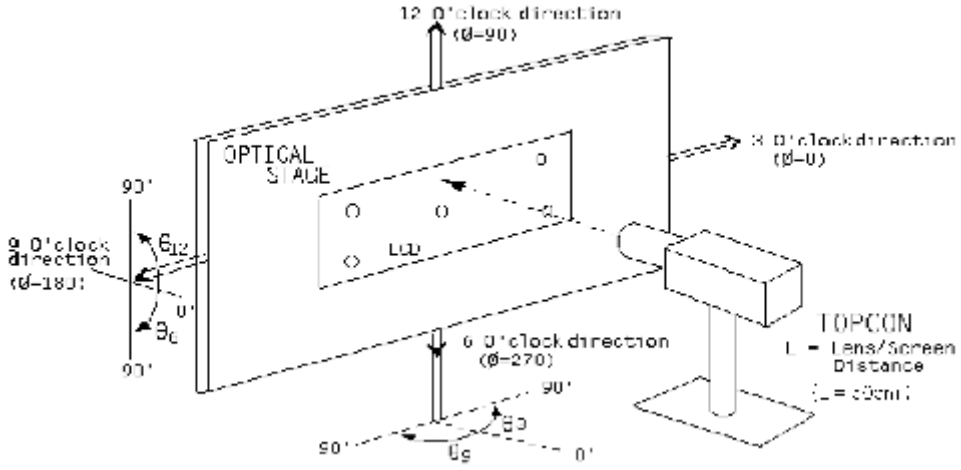
6. The electro-optical response time measurements shall be made as FIG.4 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Tf.

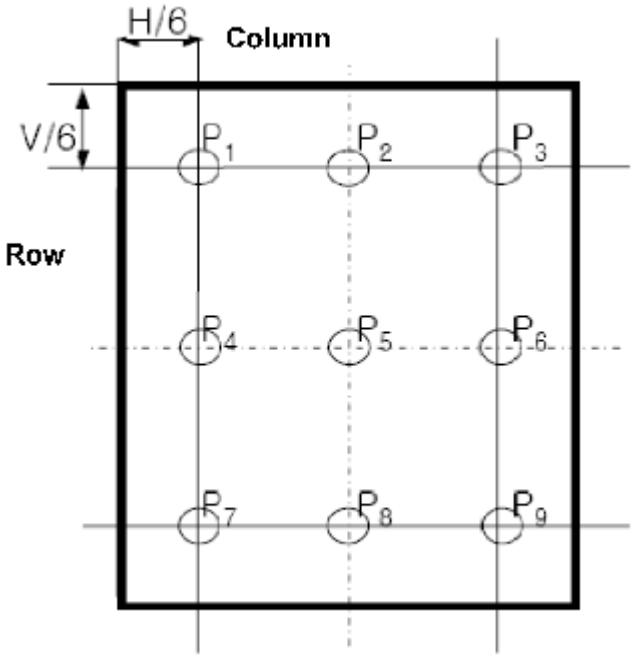
The definition of Vth & Vsat



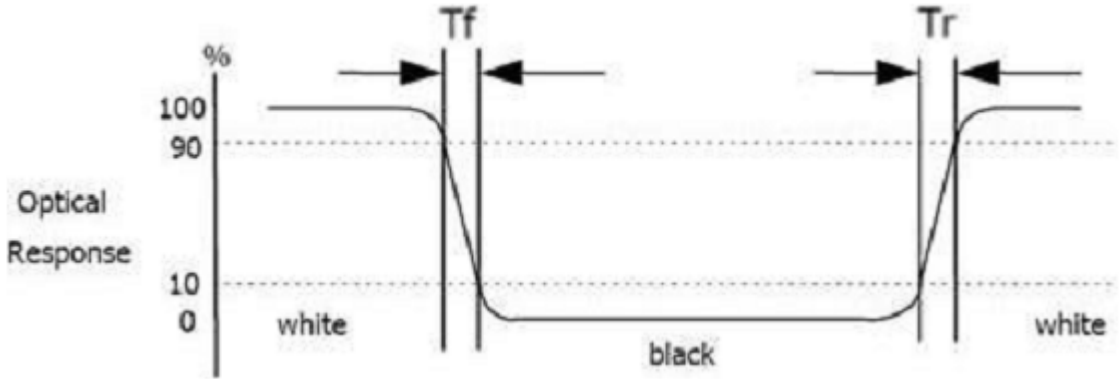

Measurement Set up



Uniformity Measurement Locations




Response Time Testing



## 8.0 MECHAICAL CHARACTERITICS

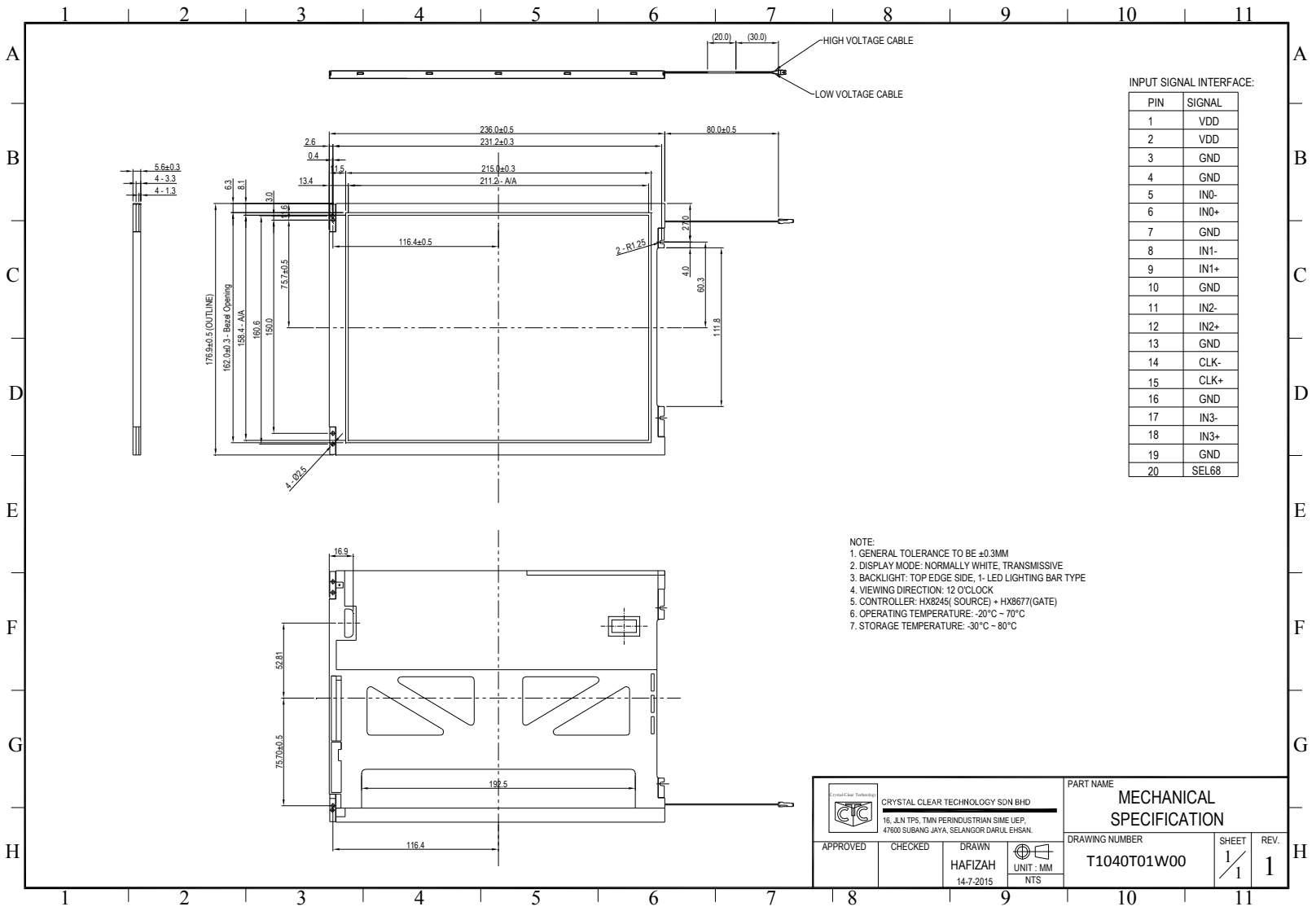
### 8.1 Dimension Requirements

Mechanical outlines for the panel (H: horizontal length, V: vertical length)

| Parameter | Specification | Unit | Remark |
|---|---|---|---|
| Panel size | 221.6(H) × 171(V) | mm | |
| CF size | 218.4(H) × 165.4(V) | mm | |
| Active area | 211.2(H) × 158.4(V) | mm | |
| Number of pixels | 800(H)RGB × 600(V)<br>(1 pixel = R + G + B dots) | pixels | |
| Pixel pitch | 0.264(H) × 0.264(V) | mm | |
| Pixel arrangement | RGB Vertical stripe | | |
| Panel ID | 10 × 2 | mm | |
| COG pad area | 5.6(Source), 3.2(Gate) | mm | |
| D-IC to FPC distance | 0.5(Source) | mm | Note |
| D-IC width | 1.07(Source), 0.67(Gate) | mm | |
| D-IC to CF edge | 2.83(Source), 1.87(Gate) | mm | |
| FPC to Glass edge | 0.3(Source) | mm | |
| FPC width | 0.9(Source) | mm | |
| Seal Area (U/D/L/R) | 3.5/3.5/3.6/3.6 | mm | |
| Dimensional outline | 236(H) × 176.9(V) × 5.6(D) | mm | |
| Display mode | Normally white | | |

Note:
The size specified in calculated by IC driver HX8245 (Source) + HX8677 (Gate), the size may be changes if customer use other IC.

# LCM Outline Dimension




INPUT SIGNAL INTERFACE:

| PIN | SIGNAL |
|---|---|
| 1 | VDD |
| 2 | VDD |
| 3 | GND |
| 4 | GND |
| 5 | IN0- |
| 6 | IN0+ |
| 7 | GND |
| 8 | IN1- |
| 9 | IN1+ |
| 10 | GND |
| 11 | IN2- |
| 12 | IN2+ |
| 13 | GND |
| 14 | CLK- |
| 15 | CLK+ |
| 16 | GND |
| 17 | IN3- |
| 18 | IN3+ |
| 19 | GND |
| 20 | SEL68 |

NOTE:
1. GENERAL TOLERANCE TO BE ±0.3MM
2. DISPLAY MODE: NORMALLY WHITE, TRANSMISSIVE
3. BACKLIGHT: TOP EDGE SIDE, 1- LED LIGHTING BAR TYPE
4. VIEWING DIRECTION: 12 O'CLOCK
5. CONTROLLER: HX8245( SOURCE) + HX8677(GATE)
6. OPERATING TEMPERATURE: -20°C ~ 70°C
7. STORAGE TEMPERATURE: -30°C ~ 80°C

CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47600 SUBANG JAYA, SELANGOR DARUL EHSAN.

PART NAME: MECHANICAL SPECIFICATION

| APPROVED | CHECKED | DRAWN | UNIT : MM | DRAWING NUMBER | SHEET | REV. |
|---|---|---|---|---|---|---|
| | | HAFIZAH 14-7-2015 | NTS | T1040T01W00 | 1/1 | 1 |

## 9.0 RELIABILITY TEST

| NO. | Test Item | Test Condition | Duration |
|---|---|---|---|
| 1 | High temperature, high humidity operation test(THO) | 60℃, 90%RH | 240hrs |
| 2 | Low temperature operation test(LTO) | -20 ℃ | 240hrs |
| 3 | High temperature operation test(HTO) | 70 ℃ | 240hrs |
| 4 | High temperature storage test(HTS) | 80℃ | 240hrs |
| 5 | Low temperature storage test(LTS) | -30℃ | 240hrs |
| 6 | Thermal shock test (TST) | -30 ℃ →80 ℃ (Per 30min ) | 100hrs |
| 7 | Altitude test(ALT) | 25℃,40000ft | 12hrs |
| 8 | On/Off | On 30s / Off 30s | 3000times |
| 9 | PCT | 121 ℃,2ATM ,100%RH | 12hr |
| 10 | ESD | 150pF 330Ω ±8KV(Air) / ±6KV(Contact) | 20points |
| 11 | Vibration | 1.5G ,10/500/10,Sine,X/Y/Z Direction | Total:30min |

# 10.0 HANDLING & CAUTIONS

## 10.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizer which easily get damaged.
- So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCD module with the specified mounting parts.

## 10.2 Caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it.
- Handling with care since shock, vibration, and careless handling may seriously affect the product.
- If it falls from a high place or receives a strong shock, the glass maybe broken.
- The polarizer on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizer or it leads the polarizer to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent recommended below to clean the LCD's surface with wipe lightly.
- -IPA (Isopropyl Alcohol), Ethyl Alcohol, Tri-chloro, tri-florothane.
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizer and others. Do not use the following solvent–Water, acetone, Aromatics.
- It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizer on the LCD's surface are vulnerable to scratch and thus to be damaged by shape particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulphur, saliva or fingerprint. To prevent from the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon
- Please clean the LCD without ultrasonic to avoid line open.

### 10.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipment's to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the
- Humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- Avoid the use work clothing made of synthetic fibres. We recommend cotton clothing or other conductivity-treated fibres.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

### 10.4 Caution For Operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCD may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCD's surface which may affect the operation of the polarizer on the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand LCD may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.  Do not disassemble and/or re-assemble LCD module

### 10.5 Packaging

- Modules use LCD element, and must be treated as such.
  -Avoid intense shock and falls from a height.
  -To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

**10.6 Storage**

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH
- Original protective film should be used on LCD's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizer.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
  -Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
  -Store in a dark place where neither exposure to direct sunlight nor light is.
  -Keep temperature in the specified storage temperature range.
  -Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation when it was delivered

**10.7 Safety**

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case of LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water and soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

11.0 APPLICATION SCOPE

- This product specification only applies to the products manufactured and sold by our company.
- Any specification, quality etc. about other parts mentioned in this product spec are no concern of our company.