

## Product Functional Specification 10.1” inch Color TFT-LCD Module

**Model Name: BE10104P-01**

**( ) Preliminary Specification**

**(\* ) Final Specification**

*Document Version: V.0*

*Date: 2014/10/29*

| Approved By   | Reviewed By | Prepared by Verification | Prepared by |
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| Note: This Specification is subject to change without notice. |             |                          |             |

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|            |                                  |             |

**Record of Revision**

| Version & Date | Page | Old Description | New Description | Remark |
|----------------|------|-----------------|-----------------|--------|
| V.0 2014/10/29 | All  | First Edition   | -               | -      |
|                |      |                 |                 |        |
|                |      |                 |                 |        |
|                |      |                 |                 |        |
|                |      |                 |                 |        |
|                |      |                 |                 |        |

## 1. Handling Precautions

- 1) Since front polarizer is easily damaged, pay attention not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open or modify the Module Assembly.
- 8) Do not press the reflector sheet at the back of the module to any directions.
- 9) In case if a Module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of the LED light bar edge. Instead, press at the far ends of the LED light bar edge softly. Otherwise the TFT Module may be damaged.
- 10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
- 11) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
- 12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.

## 2. General Description

| Items   | Unit                 | Specifications   |
|---|----------------------|--|
| Screen Diagonal   | [Inch]               | 10.1   |
| Active Area   | [mm]                 | 216.96 (H) x 135.6 (V)   |
| Pixels H x V  |                      | 1280 x 3(RGB) x 800  |
| Pixel Pitch   | [mm]                 | 0.0565 (per one triad) x 0.1695  |
| Pixel Arrangement   |                      | R.G.B.-Stripe  |
| Display Mode  |                      | Normally White. Transmissive   |
| White Luminance ( Center )                                | [cd/m <sup>2</sup> ] | 600cd/m <sup>2</sup> (Typ.)  |
| Contrast Ratio  |                      | 700 (Typ.)   |
| Optical Response Time                                     | [msec]               | 25ms (Typ.)  |
| Nominal Input Voltage VDD                                 | [Volt]               | +3.3 (Typ.)  |
| Typical Power Consumption                                 | [Watt]               | 4.902W(Typ.) (PDD=0.726+PLED=4.176)<br>VDD line : PDD (typ) = 0.726W<br>LED line : PBLU (typ) = 4.176W |
| Weight  | [Grams]              | 207.   |
| Physical Size   | [mm]                 | 229.46(H) x 149.1(V) x 3.4(D) (Tpy.)   |
| Electrical Interface                                      |                      | Digital  |
| Surface Treatment   |                      | Glare  |
| Temperature Range<br>Operating<br>Storage (Non-Operating) | [°C]<br>[°C]         | -10 to +50<br>-20 to +60   |

### 3. Pin Assignment

FPC Connector is used for the module electronics interface. The model is F62240-H1210A. manufactured by Vigorconn.

| Pin No. | Symbol    | Description                                   | Remark |
|---------|-----------|---|--------|
| 1       | Dither    | 6/8bit selection                              | Note1  |
| 2       | VDD       | Power Voltage for digital circuit             |        |
| 3       | VDD       | Power Voltage for digital circuit             |        |
| 4       | NC        | No connectin                                  |        |
| 5       | NC        | No connectin                                  |        |
| 6       | L/R       | Horizontal inversion                          | Note2  |
| 7       | U/D       | Vertical inversion                            | Note2  |
| 8       | RXIN0-    | Negative LVDS differential data input (0)     |        |
| 9       | RXIN0+    | Positive LVDS differential data input (0)     |        |
| 10      | GND       | Power Ground                                  |        |
| 11      | RXIN1-    | Negative LVDS differential data input (1)     |        |
| 12      | RXIN1+    | Positive LVDS differential data input (1)     |        |
| 13      | GND       | Power Ground                                  |        |
| 14      | RXIN2-    | Negative LVDS differential data input (2)     |        |
| 15      | RXIN2+    | Positive LVDS differential data input (2)     |        |
| 16      | GND       | Power Ground                                  |        |
| 17      | RXCL KIN- | Negative LVDS differential data input (clock) |        |
| 18      | RXCL KIN+ | Positive LVDS differential data input (clock) |        |
| 19      | GND       | Power Ground                                  |        |
| 20      | RXIN3-    | Negative LVDS differential data input (3)     |        |
| 21      | RXIN3+    | Positive LVDS differential data input (3)     |        |
| 22      | GND       | Power Ground                                  |        |
| 23      | NC        | No connectin                                  |        |
| 24      | NC        | No connectin                                  |        |
| 25      | NC        | No connectin                                  |        |
| 26      | NC        | No connectin                                  |        |
| 27      | NC        | No connectin                                  |        |
| 28      | NC        | No connectin                                  |        |
| 29      | CABC_EN1  | CABC H/W enable                               | Note3  |
| 30      | CABC_EN0  | CABC H/W enable                               | Note3  |
| 31      | NC        | No connectin                                  |        |
| 32      | NC        | No connectin                                  |        |

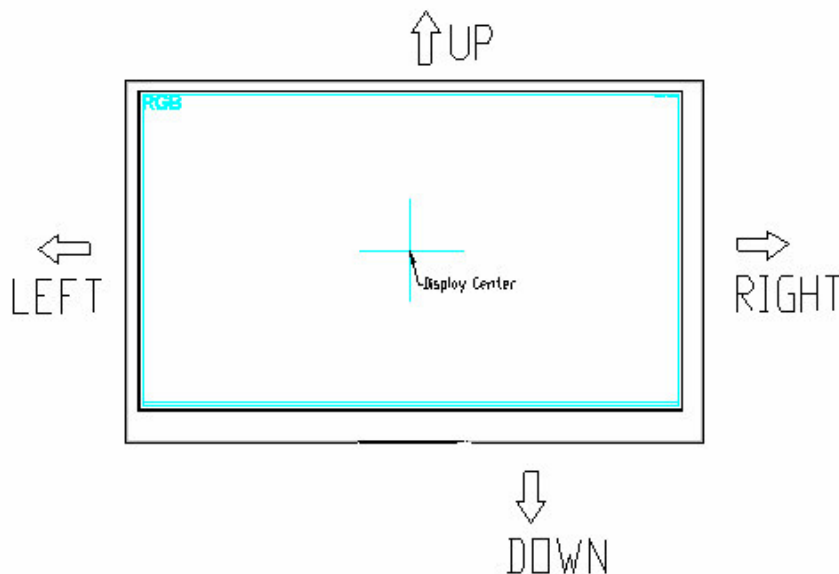
|    |    |              |  |
|----|----|--------------|--|
| 33 | NC | No connectin |  |
| 34 | NC | No connectin |  |
| 35 | NC | No connectin |  |
| 36 | NC | No connectin |  |
| 37 | NC | No connectin |  |
| 38 | NC | No connectin |  |
| 39 | NC | No connectin |  |
| 40 | NC | No connectin |  |

**Note1:** If LVDS input data is 6 bits ,DITHER must be set to High;  
If LVDS input data is 8 bits ,DITHER must be set to Low.

**Note2:** When L/R=" 0" , set right to left scan direction.  
When L/R=" 1" , set left to right scan direction.  
When U/D=" 0" , set top to bottom scan direction.  
When U/D=" 1" , set bottom to top scan direction.

**Note3:** When CABC\_EN=" 00" , CABC OFF.  
When CABC\_EN=" 01" , user interface image.  
When CABC\_EN=" 10" , still picture.  
When CABC\_EN=" 11" , moving image

**Note:** Definition of scanning direction.  
Refer to the figure as below:



## 4. Operation Specifications

### 4.1. Absolute Maximum Ratings

| Item                  | Symbol           | Values |      | Unit | Remark |
|-----------------------|------------------|--------|------|------|--------|
|                       |                  | Min.   | Max. |      |        |
| Power voltage         | V <sub>DD</sub>  | 2.7    | 5    | [V]  |        |
|                       | V <sub>LED</sub> | 17     | 17.6 | [V]  |        |
| Operating Temperature | T <sub>OP</sub>  | 0      | +50  | [°C] |        |
| Storage Temperature   | T <sub>ST</sub>  | -20    | +60  | [°C] |        |

**Note :** The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

#### 4.1.1. Typical Operation Conditions

| Item                | Symbol            | Values |        |      | Unit | Remark        |
|---------------------|-------------------|--------|--------|------|------|---------------|
|                     |                   | Min.   | Typ.   | Max. |      |               |
| Power voltage       | V <sub>DD</sub>   | 3.1    | 3.3    | 3.5  | [V]  | <b>Note 1</b> |
|                     | V <sub>LED</sub>  | 17     | 17.3   | 17.6 | [V]  | <b>Note 2</b> |
| Current Consumption | I <sub>VDD</sub>  | -      | 220    | -    | [mA] |               |
|                     | I <sub>VLED</sub> | 230    | 240    | 260  | [mA] | <b>Note 3</b> |
| LED life time       | -                 | -      | 12,000 | -    | [Hr] | <b>Note 4</b> |

**Note 1:** V<sub>DD</sub> setting should match the signals output voltage of customer's system board.

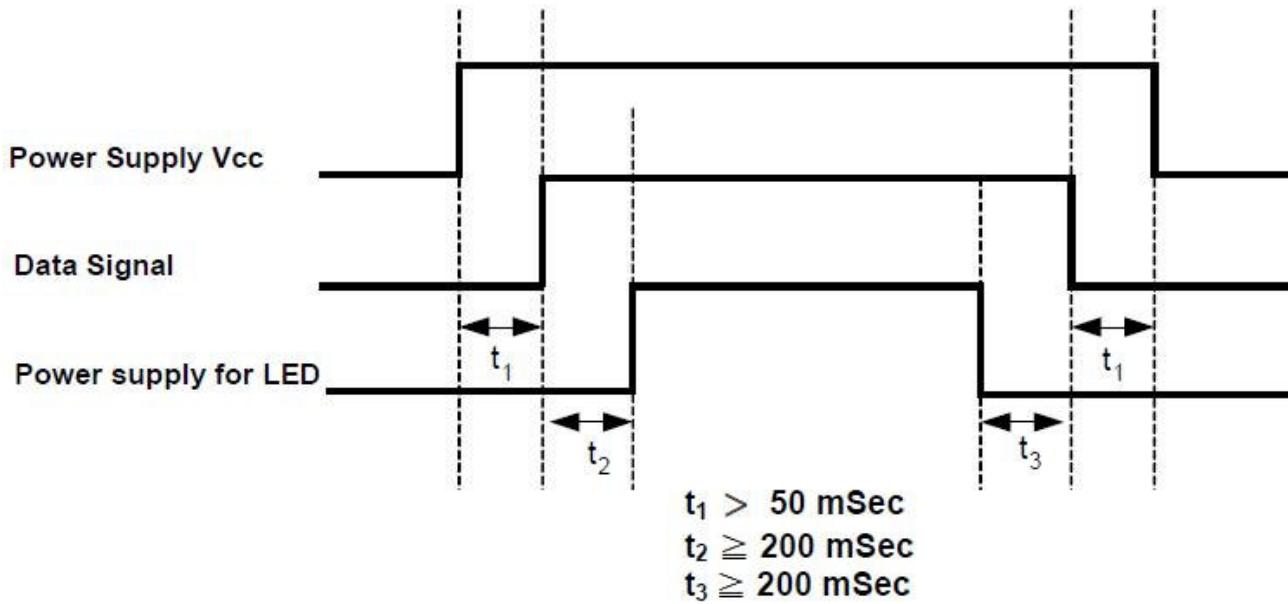
**Note 2:** LED driving voltage.

**Note 3:** LED driving current.

**Note 4:** The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C and V<sub>LED</sub> =17.3V. The LED lifetime could be decreased if operating V<sub>LED</sub> is larger than 17.3V or the Ta is higher than 25°C



## 4.2. Power Sequence



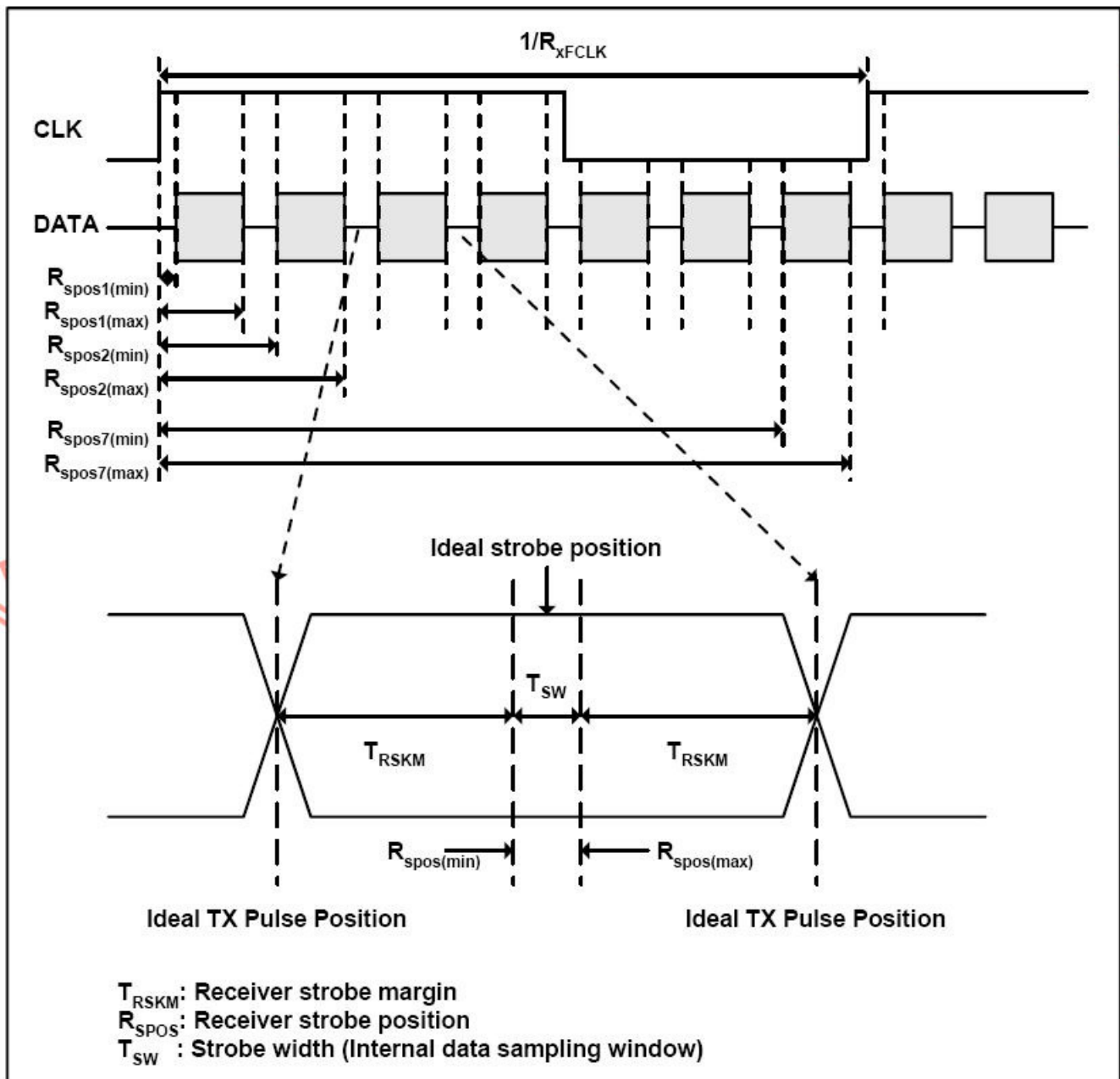
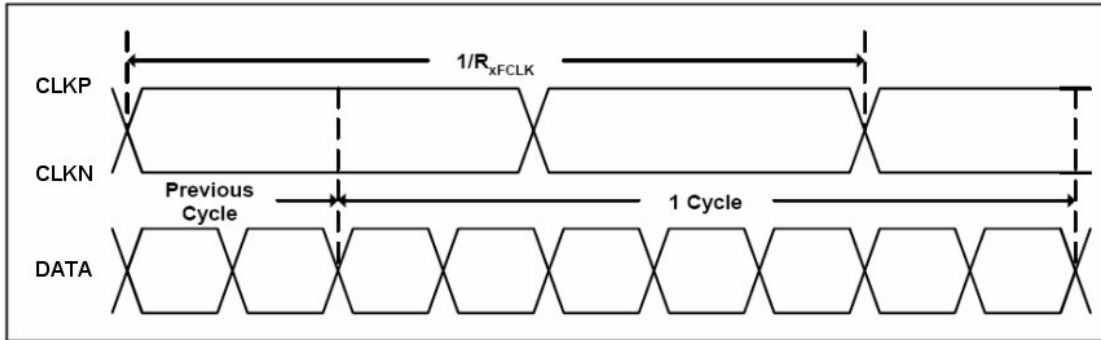
Note: Data Signal includes Rin0- ~ Rin3-, Rin0+ ~ Rin3+, CLKIN-, CLKIN+.

## 4.3. Timing Characteristics

### 4.3.1. AC Electrical Characteristics

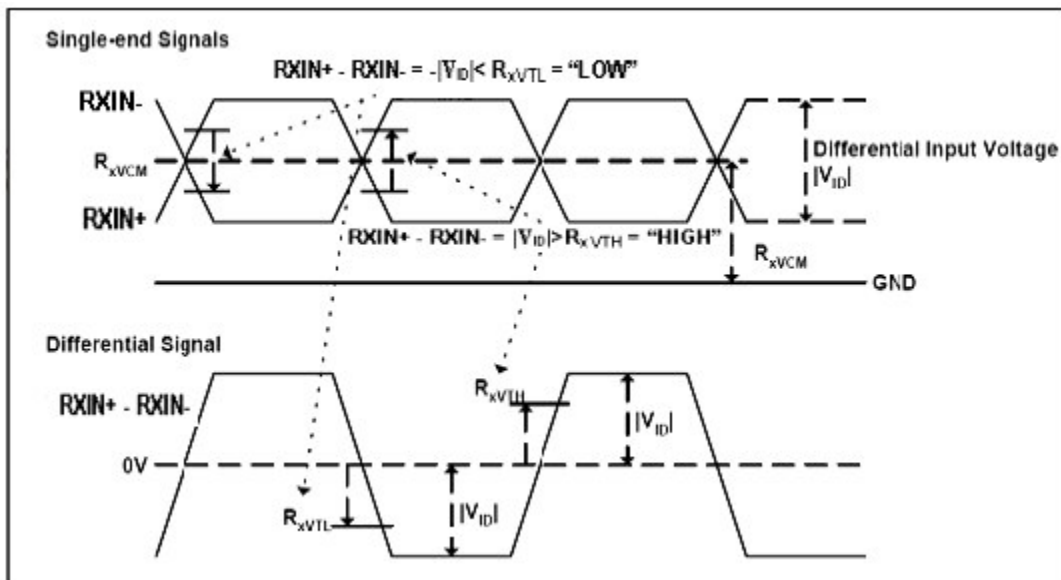
| Parameter              | Symbol | Values |                         |      | Unit | Remark |
|------------------------|--------|--------|-------------------------|------|------|--------|
|                        |        | Min.   | Typ.                    | Max. |      |        |
| Clock frequency        | RXFCLK | 20     | -                       | 81   | MHz  |        |
| Input data skew margin | TRSKM  | 500    | -                       | -    | ps   |        |
| Clock high time        | TLVCH  | -      | $4/(7 * \text{RXFCLK})$ | -    | ns   |        |
| Clock low time         | TLVCL  | -      | $3/(7 * \text{RXFCLK})$ | -    | ns   |        |

### 4.3.2. Input Clock and Data Timing Diagram



## Electrical Characteristics

| Parameter                                 | Symbol         | Values       |      |                  | Unit    | Remark          |
|---|----------------|--------------|------|------------------|---------|-----------------|
|   |                | Min.         | Typ. | Max.             |         |                 |
| Differential input high Threshold voltage | $R_{XVTH}$     | -            | -    | +0.1             | V       | $R_{XVCM}=1.2V$ |
| Differential input low Threshold voltage  | $R_{XVTL}$     | -0.1         | -    | -                | V       |                 |
| Input voltage range (singled-end)         | $R_{XVIN}$     | 0            | -    | 2.4              | V       |                 |
| Differential input common mode voltage    | $R_{XVCM}$     | $ V_{ID} /2$ | -    | $2.4- V_{ID} /2$ | V       |                 |
| Differential voltage                      | $ V_{ID} $     | 0.2          | -    | 0.6              | V       |                 |
| Differential input leakage current        | $R_{V_{Xliz}}$ | -10          | -    | +10              | $\mu A$ |                 |

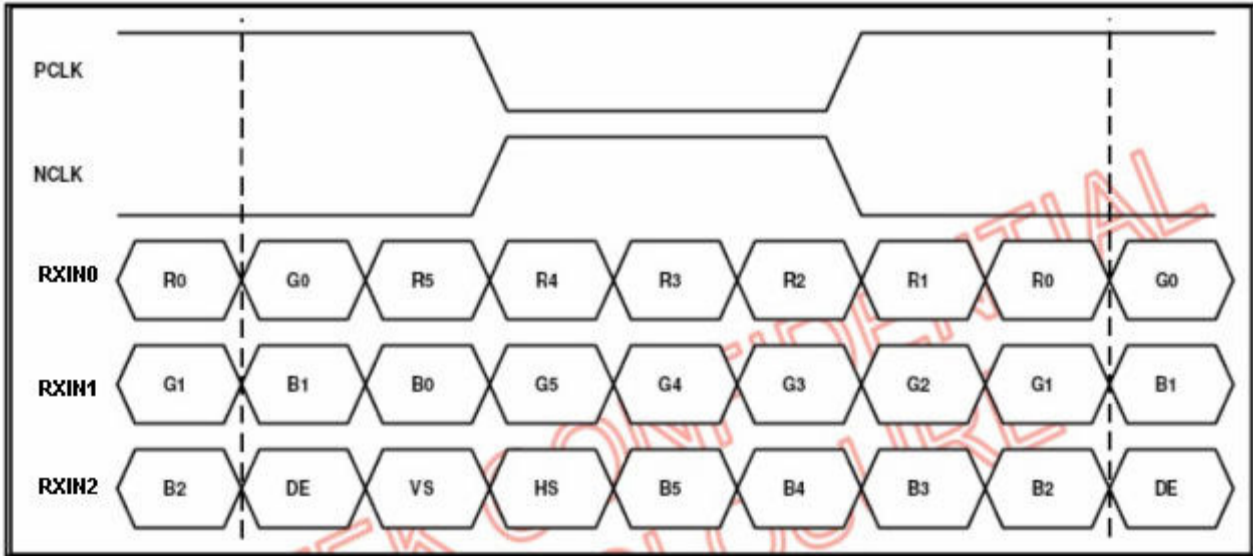


## 4.3.4. Timing

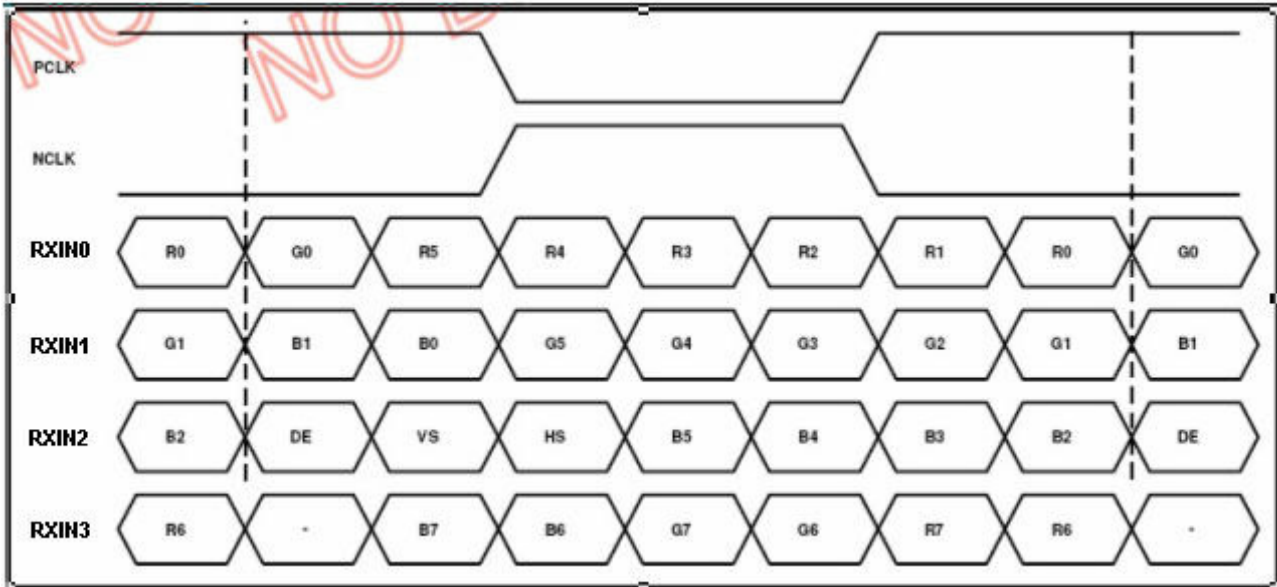
| Parameter               | Symbol | Values |      |      | Unit | Remark                  |
|-------------------------|--------|--------|------|------|------|-------------------------|
|                         |        | Min.   | Typ. | Max. |      |                         |
| Clock Frequency         | fclk   | 66.6   | 72.4 | 78.9 | MHz  | <b>Frame rate =60Hz</b> |
| Horizontal display area | thd    | 1280   |      |      |      |                         |
| HS period time          | th     | 1370   | 1440 | 1500 | DCLK |                         |
| HS Blanking             | thb    | 90     | 160  | 220  | DCLK |                         |
| Vertical display area   | tvd    | 800    |      |      |      |                         |
| VS period time          | tv     | 810    | 838  | 877  | H    |                         |
| VS Blanking             | thb    | 10     | 38   | 77   | H    |                         |

## 4.3.5. Data Input Format

6bit LVDS input



8bit LVDS input



**Note:** Support DE timing mode only, SYNC mode not supported.

## 5. Optical Characteristics

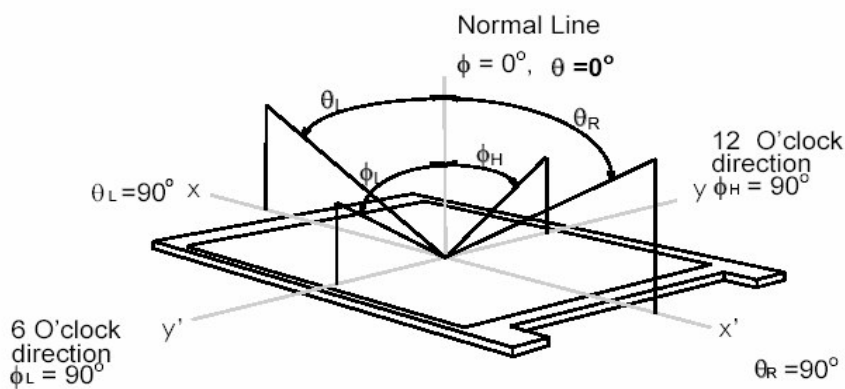
The optical characteristics are measured under stable conditions at 25°C (Room Temperature):

| Item   | Unit                 | Conditions                           | Min.         | Typ.     | Max.         | Note         |
|--|----------------------|--------------------------------------|--------------|----------|--------------|--------------|
| White Luminance                                | [cd/m <sup>2</sup> ] | (center point)                       | 530          | 600      | -            | Note 4       |
| Uniformity                                     | [%]                  | 9 Points                             | 70           | 75       | -            | Note 2, 3, 4 |
| Contrast Ratio                                 |                      | Normal Direction                     | 500          | 700      | -            | Note 4       |
| Response Time                                  | [msec]               | Raising Time (TrR)                   | -            | 10       | 20           | Note 5       |
|  |                      | Falling Time (TrF)                   | -            | 15       | 30           |              |
|  |                      | Raising + Falling                    | -            | 25       | 50           |              |
| Viewing Angle                                  | [degree]             | Horizontal (Right)<br>CR = 10 (Left) | 65<br>65     | 75<br>75 | -            | Note 1       |
|  |                      | Vertical (Upper)<br>CR = 10 (Lower)  | 65<br>60     | 75<br>70 | -            |              |
| Color / Chromaticity Coordinates<br>(CIE 1931) |                      | Red x                                | Typ-<br>0.03 | 0.634    | Typ+<br>0.03 | Note 4       |
|  |                      | Red y                                |              | 0.341    |              |              |
|  |                      | Green x                              |              | 0.351    |              |              |
|  |                      | Green y                              |              | 0.599    |              |              |
|  |                      | Blue x                               |              | 0.155    |              |              |
|  |                      | Blue y                               |              | 0.062    |              |              |
|  |                      | White x                              |              | 0.336    |              |              |
|  |                      | White y                              |              | 0.341    |              |              |

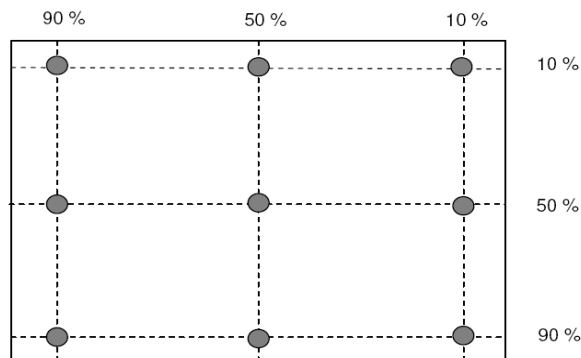
Optical Equipment: DT-100 or equivalent

**Note 1:** Definition of viewing angle

Viewing angle is the measurement of contrast ratio  $\geq 10$ , at the screen center, over a  $180^\circ$  horizontal and  $180^\circ$  vertical range (off-normal viewing angles). The  $180^\circ$  viewing angle range is broken down as below:  $90^\circ$  ( $\theta$ ) horizontal left and right, and  $90^\circ$  ( $\Phi$ ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.



**Note 2:** Definition of 9 points position

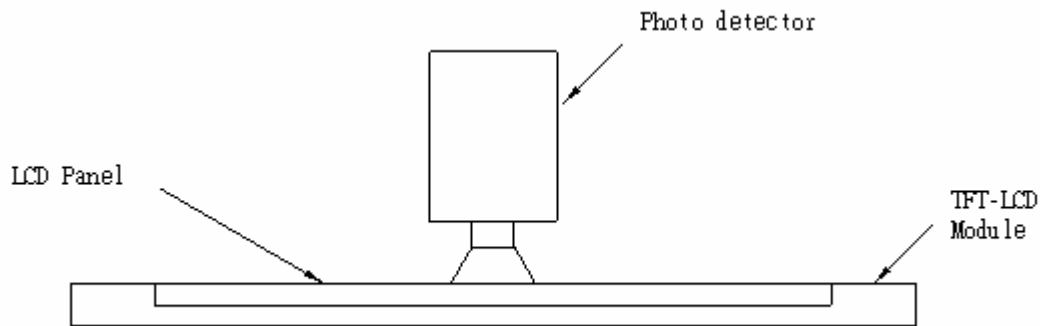


**Note 3:** The luminance uniformity of 9 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta_{w9} = \frac{\text{Minimum Luminance of 9 points}}{\text{Maximum Luminance of 9 points}}$$

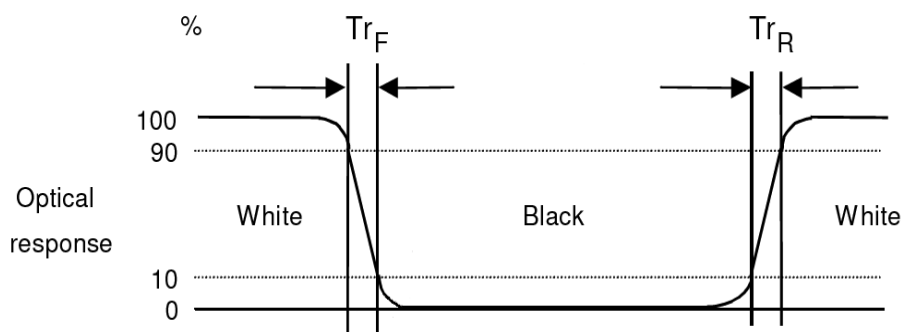
**Note 4:** Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room. Optical Equipment: DT-100, or equivalent



**Note 5:** Definition of response time:

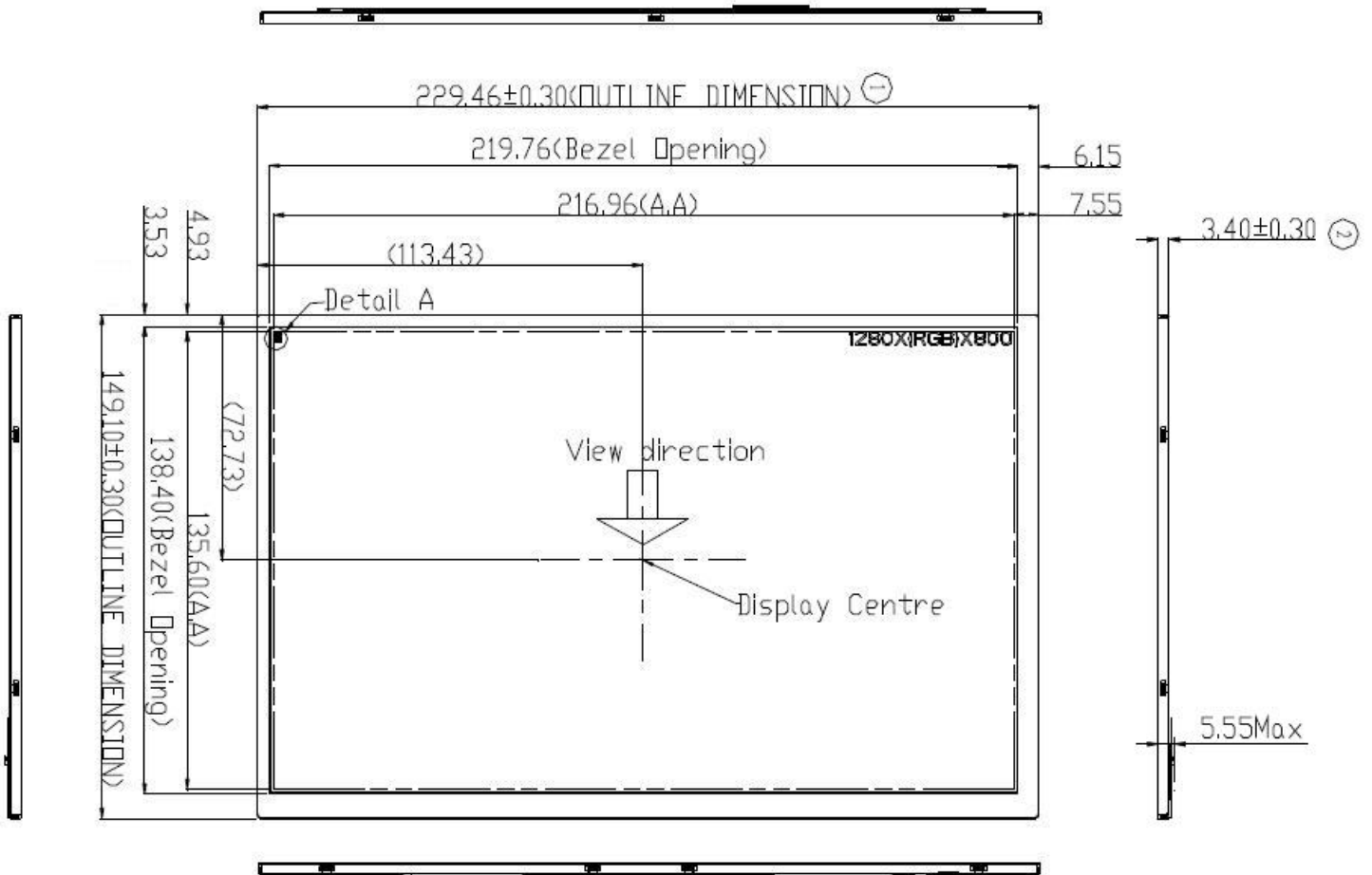
The output signals of photo detector are measured when the input signals are changed from “White” to “Black” (falling time) and from “Black” to “White”(rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.





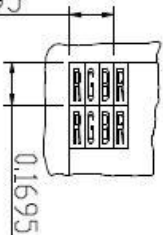
## 6. Mechanical Characteristic

### LCM Outline Dimension (Front View)



Dots DETAIL A

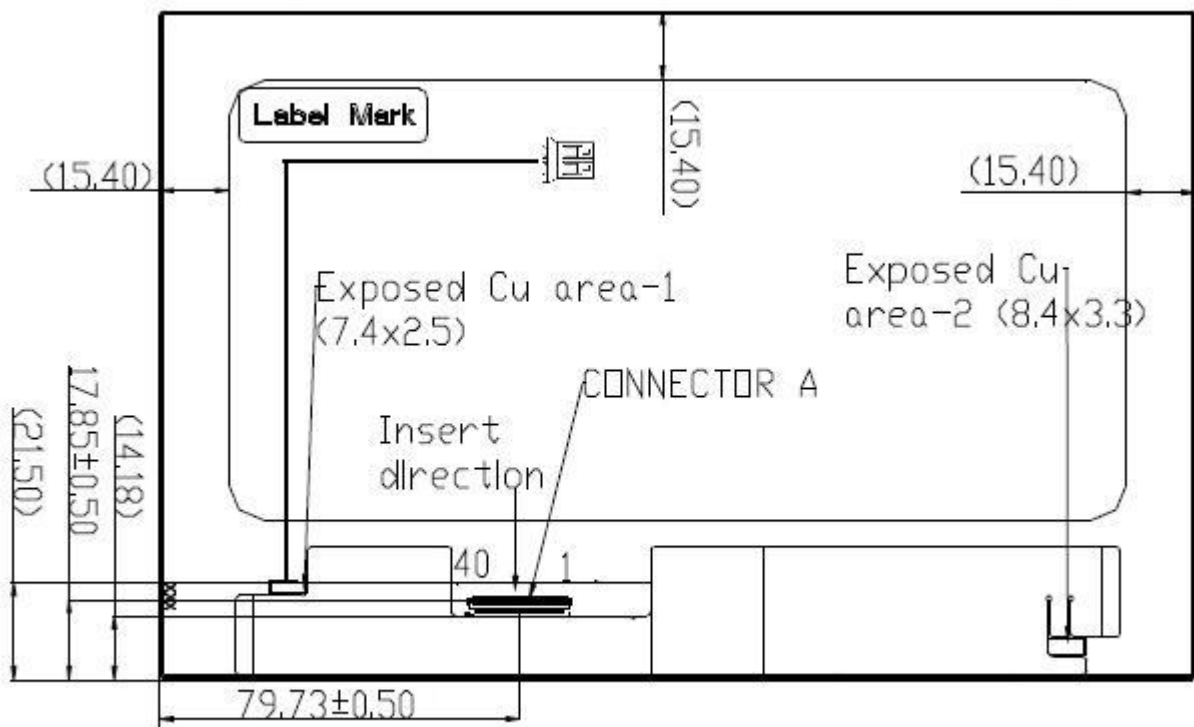
0.1695



NOTES:

- 1.Connector A (40PIN): F62240-H12100,
- 2.General tolerance  $\pm 0.30$ .

## LCM Outline Dimension (Rear View)



## 7. LED light bar connector

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

| Connector Name / Designation  | LED Light Bar Connector |
|-------------------------------|-------------------------|
| Manufacturer                  |                         |
| Connector Model Number        | A20D/HD2-2P             |
| Mating Connector Model Number |                         |

### 7.1 Signal for LED light bar connector

| Pin# | Symbol | Cable Color | Function         |
|------|--------|-------------|------------------|
| 1    | HV     | Red         | LED High Voltage |
| 2    | LV     | Black       | Ground           |

- ◆ Cable length:  $200 \pm 5$  mm
- ◆ Connector-output position: right side (front view)
- ◆ LED light bar assembly design shall be easy for replacement and repair