

Fema Part Number

|                          |  |
|--------------------------|--|
| GM1024768A-150-TTX3NLW-H |  |
| Description              | 15.0" Full Color TFT Display                                     |
|                          | 1024x768 Resolution  |
|                          | Brightness = 1500 nits (Typical)                                 |
|                          | Wide Operating Temperature ( -30 to 80 Degrees Celcius)          |
|                          | Optional Resistive or Projected Capacitive Touch Panel Available |

Fema Electronics Corporation:

17815 Newhope Street, Suite H, Fountain Valley, CA 92708 Tel: 714-825-0140

Please visit our website [www.femaelectronics.com](http://www.femaelectronics.com) or email us at [tft@femacorp.com](mailto:tft@femacorp.com)

## 2. General Description

### 2.1, Overview

GM1024768A-150-TTX3NLW-H is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display, a driver circuit, and a backlight system. The screen format is intended to support XGA (1024(H) x 768(V)) screen and 16.2M (RGB 8-bits) or 262k (RGB 6-bits). All input signals are LVDS interface compatible. All the design rules of this module can correspond to PSWG standard.

### 2.2 Features

- Sunlight readable display, 1500nits.
- LED backlight
- Wide temperature operating
- RoHS Compliance

### 2.3 Application

Industrial Application.

## 2.4 Display Specifications

| Items   | Unit              | Specification  |
|---|-------------------|--|
| Screen Diagonal                               | inch              | 15   |
| Active Area                                   | mm                | 304.128(H) x 228.096(V)                                |
| Pixels H x V                                  | pixels            | 1024x3(RGB) x 768                                      |
| Pixels Pitch                                  | um                | 297 (per one triad) x 297                              |
| Pixel Arrangement                             |                   | RGBW Rectangle   |
| Display mode                                  |                   | TN mode, normally white                                |
| White luminance (center)                      | Cd/m <sup>2</sup> | 1500 (Typ.)  |
| Contrast ratio                                |                   | 700 (Typ.)   |
| Optical Response Time                         | msec              | 8 ms (Typ. on/off)                                     |
| Normal Input Voltage VDD                      | Volt              | 3.3  |
| Power Consumption<br>(VDD Line + LED L Lines) | Watt              | 16.6   |
| Weight  | Grams             | 1000 typ.  |
| Physical size                                 | mm                | 326.5(H)x 253.5(V) x 13.1(D) (typ.)                    |
| Electrical Interface                          |                   | 1 Channel LVDS   |
| Support Colors                                |                   | 16.2 M colors (RGB 8-bits)<br>262 k color (RGB 6-bits) |
| Surface Treatment                             |                   | AG, 3H   |
| Temperature range                             |                   |  |
| Operating                                     | °C                | -30 ~ 85   |
| Storage (Shipping)                            | °C                | -30 ~ 85   |
| RoHS Compliance                               |                   | RoHS Compliance  |

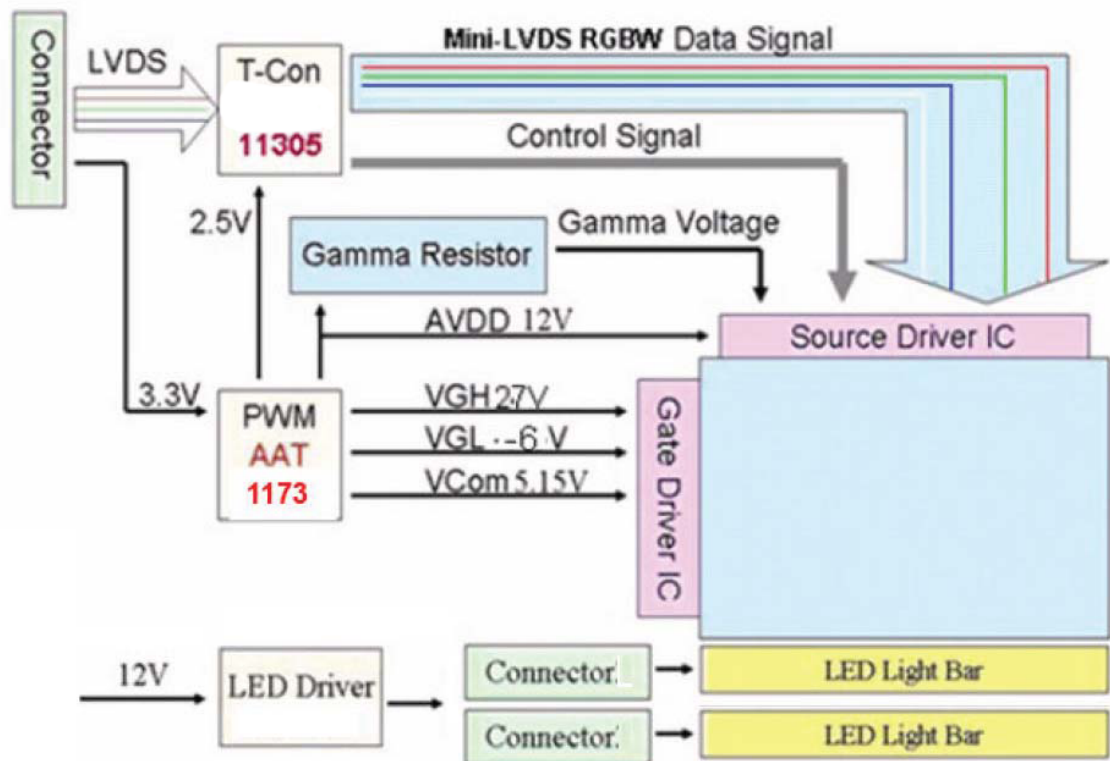
## 2.5 Optical Characteristics

The following optical characteristics are measured under stable condition at 25 °C

| Items                                     | Unit              | Conditions                         | Min.  | Typ.  | Max.  | Note |
|---|-------------------|------------------------------------|-------|-------|-------|------|
| Viewing angle                             | Deg.              | Horizontal (Right)<br>CR=10 (Left) | 140   | 160   |       | 2    |
|   |                   | Vertical (Up)<br>CR=10 (Down)      | 120   | 140   |       |      |
| Contrast Ratio                            |                   | Normal Direction                   | 400   | 700   |       | 3    |
| Response Time                             | msec              | Raising time ( $T_{rR}$ )          |       | 5.7   |       | 4    |
|   |                   | Falling time ( $T_{rF}$ )          |       | 2.3   |       |      |
|   |                   | Raising + Falling                  |       | 8     |       |      |
| Color / Chromaticity<br>Coordinates (CIE) |                   | Red x                              | -0.03 | TBD   | +0.03 | 5    |
|   |                   | Red y                              |       | TBD   |       |      |
|   |                   | Green x                            |       | TBD   |       |      |
|   |                   | Green y                            |       | TBD   |       |      |
|   |                   | Blue x                             |       | TBD   |       |      |
|   |                   | Blue y                             |       | TBD   |       |      |
| Color coordinates<br>(CIE) White          |                   | White x                            |       | 0.313 |       |      |
|   |                   | White y                            |       | 0.329 |       |      |
| Center Luminance                          | Cd/m <sup>2</sup> |                                    | 1200  | 1500  |       | 6    |
| Luminance Uniformity                      | %                 |                                    | 75    |       |       | 7    |
| Crosstalk (in 60 Hz)                      | %                 |                                    |       |       | 1.2   |      |
| Flicker                                   | dB                |                                    |       |       | -20   |      |

### 3. Functional Block Diagram

The following diagram shows the functional block of the 15 inches Color TFT-LCD Module:



## 4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

### 4.1 TFT LCD Module

| Items                    | Symbol          | Min  | Max | Unit | Conditions |
|--------------------------|-----------------|------|-----|------|------------|
| Logic/ LCD drive voltage | V <sub>in</sub> | -0.3 | 3.6 | Volt | Note 1, 2  |

### 4.2 Backlight unit

| Items       | Symbol           | Min | Max | Unit | Conditions |
|-------------|------------------|-----|-----|------|------------|
| LED Current | I <sub>LED</sub> |     | 560 | mA   | Note 1, 2  |

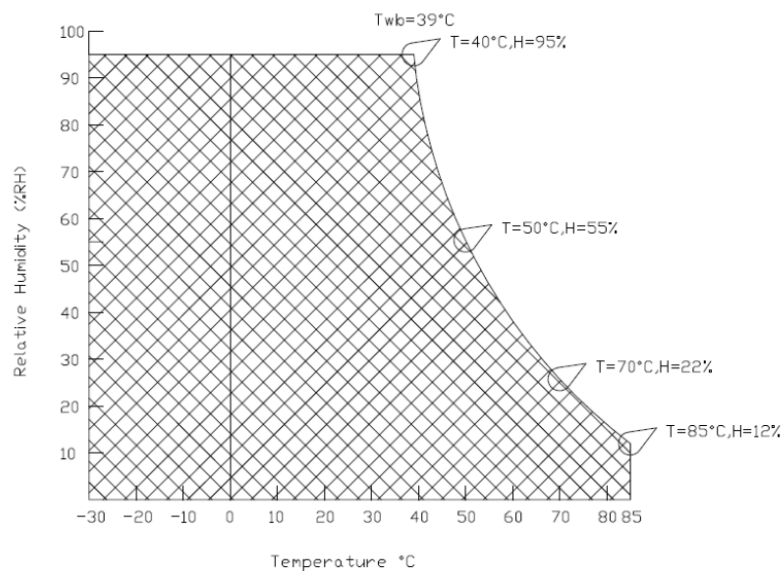
### 4.3 Absolute Ratings of Environment

| Items                 | Symbol          | Values |      |      | Unit | Conditions |
|-----------------------|-----------------|--------|------|------|------|------------|
|                       |                 | Min.   | Typ. | Max. |      |            |
| Operation temperature | T <sub>OP</sub> | -30    | -    | 85   | °C   | Note 3     |
| Operation Humidity    | H <sub>OP</sub> | 8      |      | 90   | %    |            |
| Storage temperature   | T <sub>ST</sub> | -30    |      | 85   | °C   |            |
| Storage Humidity      | H <sub>ST</sub> | 8      |      | 90   | %    |            |

Note 1: With in T<sub>a</sub>= 25°C

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).



## 5. Electrical characteristics

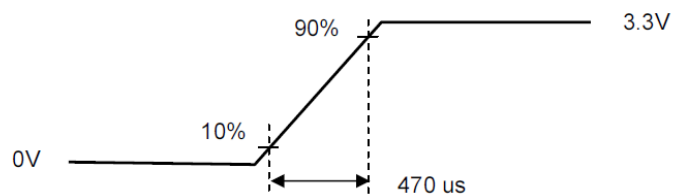
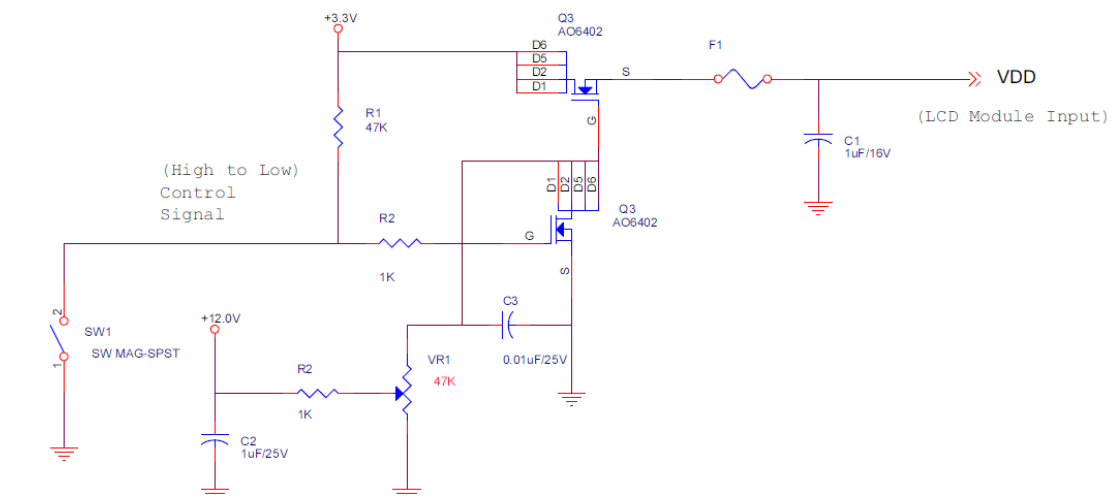
### 5.1 TFT LCD Module

#### 5.1.1 Power Specification

Input power specifications are as follows

| Symbol | Parameter                | Min | Typ. | Max | Unit | Conditions                   |
|--------|--------------------------|-----|------|-----|------|------------------------------|
| VDD    | Logic/ LCD Drive Voltage | 3   | 3.3  | 3.6 | Volt | +/- 10%                      |
| IDD    | Input current            |     | 1.0  |     | mA   | VDD=3.3V, All black pattern. |
| PDD    | VDD power                |     | 3.3  | 3.6 | W    | VDD=3.3V, All black pattern. |
| IRush  | Inrush current           |     |      | 3   | A    |                              |

Note 1: Measurement condition:



VDD rising time



64 Gray pattern

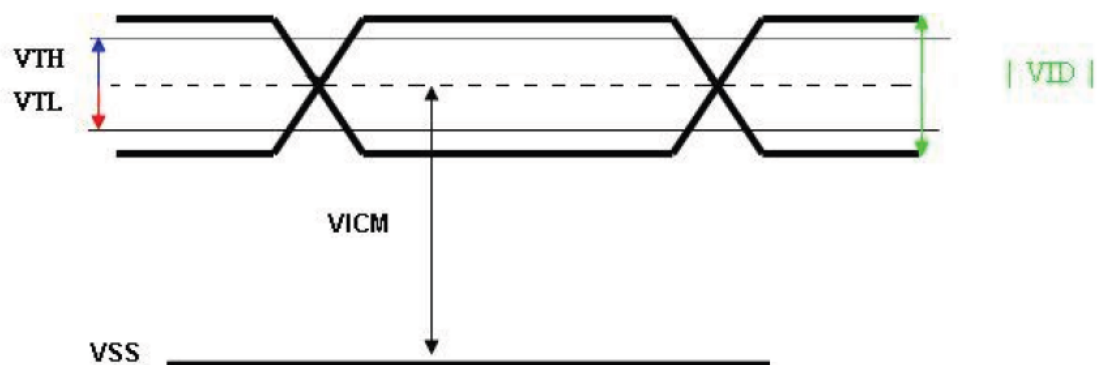
### 5.1.2 Signal Electrical Characteristics

Input signal shall be low or Hi-Z state when VDD is off.

Characteristics of each signal are as following:

| Symbol | Parameter                              | Min   | Typ | Max   | Unit | Condition       |
|--------|--|-------|-----|-------|------|-----------------|
| VTH    | Differential Input High Threshold      |       |     | +100  | mV   | VICM = 1.2V     |
| VTL    | Differential Input Low Threshold       | -100  |     |       | mV   | VICM = 1.2V     |
| VID    | Input Differential Voltage             | 100   | 400 | 600   | mV   |                 |
| VICM   | Differential Input Common Mode Voltage | +1.15 | 1,2 | +1.45 | V    | VTH/VTL = 100mV |

Note: LVDS Signal Waveform.





## 5.2 Backlight Unit

Parameter guideline is under stable conditions at 25°C (Room Temperature):

| Parameter             | Min    | Typ  | Max | Unit   | Note |
|-----------------------|--------|------|-----|--------|------|
| LED voltage (VL)      |        | 19.8 |     | [V]    | 2    |
| LED current (IL)      |        | 330  | 420 | [mA]   | 2,   |
| LED power consumption |        | 13   |     | [W]    | 3    |
| LED Life Time(LTLED)  | 50,000 |      |     | [Hour] | 1    |

Note 1: The “LED lift time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C and typical LED Current at 330 mA (Long lifetime mode).

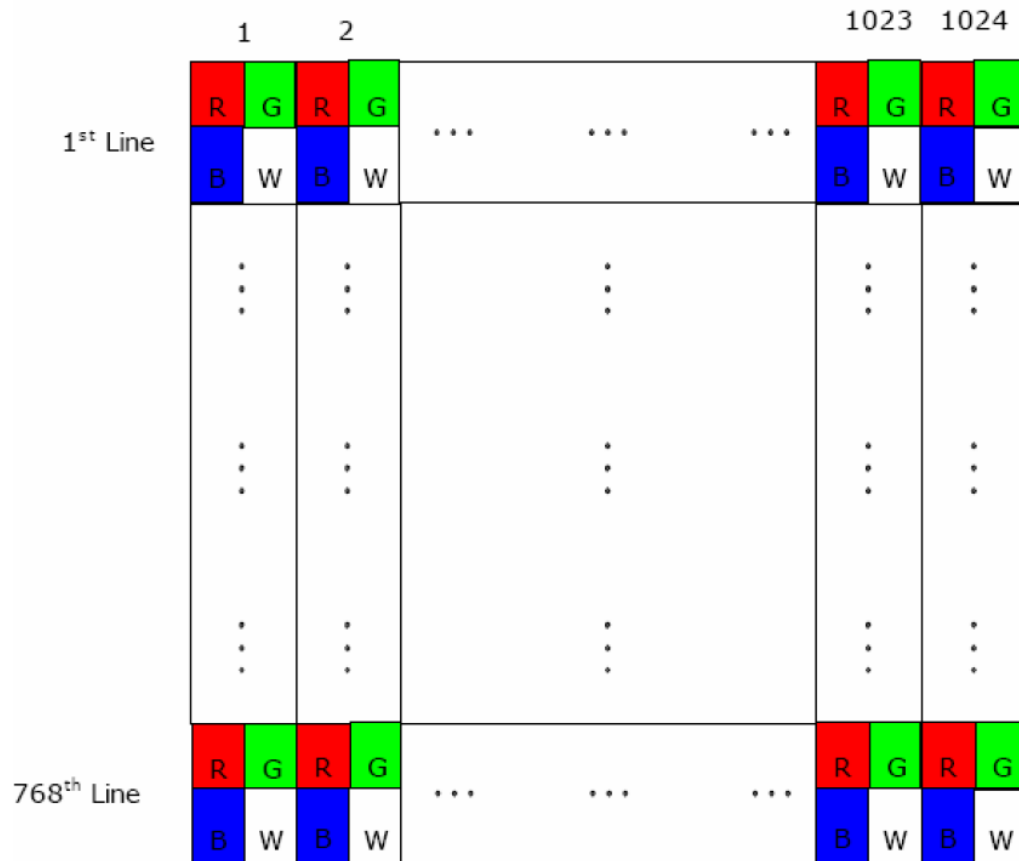
Note 2: The LED driving condition is defined for each LED module.(7 LED Serial, a LED includes 6 Chips)

Note 3: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference ( $IL \times VL \times 2 = PLED$ )

## 6. Signal Characteristic

### 6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



### 6.2 Scanning Direction:

The following figures show the image seen from the front view. The arrow indicates the direction of scan.

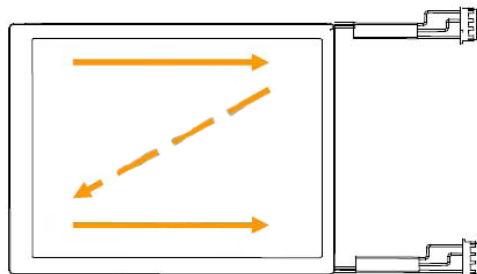


Fig. 1 Normal scan (Pin4, REV = Low or NC)

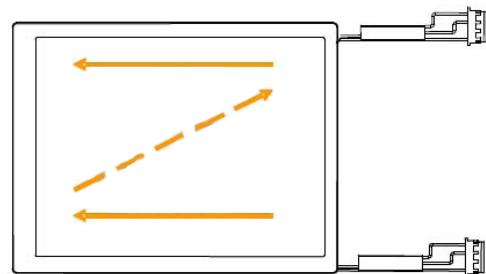


Fig. 2 Reverse scan (Pin4, REV = High)

### 6.3 Signal Description

The module using a pair of LVDS receiver SN75LVDS82(Texas Instruments) or ompatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS83(negative edge sampling) or compatible. The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

| Input Signal Interface |        |   |
|------------------------|--------|---|
| Pin No.                | Symbol | Description   |
| 1                      | VDD    | Power Supply, 3.3V (typical)  |
| 2                      | VDD    | Power Supply, 3.3V (typical)  |
| 3                      | GND    | Ground  |
| 4                      | REV    | Reverse Scan [H: Enable; L/NC: Disable]* <b>Note1,3</b>                           |
| 5                      | Rin0-  | - LVDS differential data input  |
| 6                      | Rin0+  | + LVDS differential data input  |
| 7                      | GND    | Ground  |
| 8                      | Rin1-  | - LVDS differential data input  |
| 9                      | Rin1+  | + LVDS differential data input  |
| 10                     | GND    | Ground  |
| 11                     | Rin2-  | - LVDS differential data input  |
| 12                     | Rin2+  | + LVDS differential data input  |
| 13                     | GND    | Ground  |
| 14                     | ClkIN- | - LVDS differential clock input   |
| 15                     | ClkIN+ | + LVDS differential clock input   |
| 16                     | GND    | Ground  |
| 17                     | Rin3-  | - LVDS differential data input * <b>Note2</b>                                     |
| 18                     | Rin3+  | + LVDS differential data input * <b>Note2</b>                                     |
| 19                     | NC/GND | Reserved for AUO internal test. Please set it as NC or Ground.                    |
| 20                     | SEL68  | Selection for 6 bits/8bits LVDS data input[H/NC: 6bits, L: 8bits]* <b>Note1,3</b> |

Note 1: Input signals shall be in low status when VDD is off.

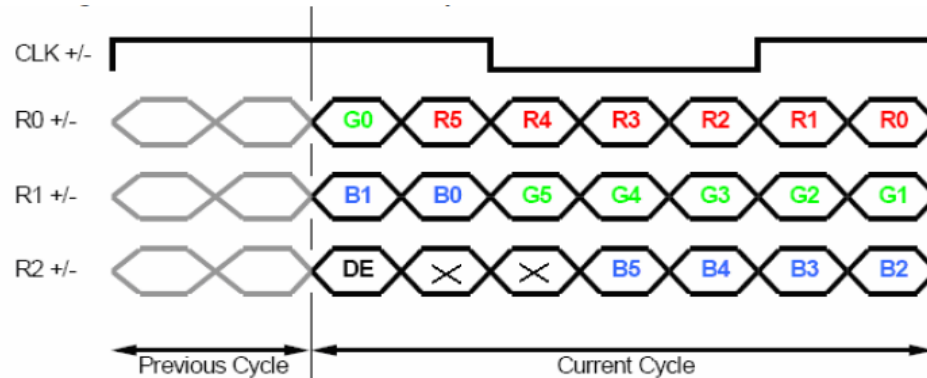
Note 2: For 6bits input mode, pin 17 and pin 18 must be floated.

Note 3: High stands for “3.3V”, Low stands for “GND”, NC stands for “No Connection”.

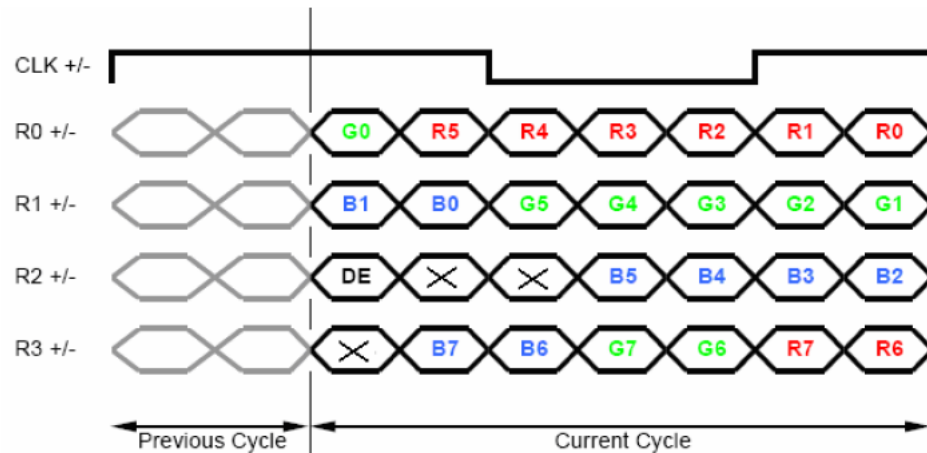
## 6.4 The Input Data Format

### 6.4.1 SEL68

SEL68 = "High" or "NC" for 6 bits LVDS Input



SEL68 = "Low" for 8 bits LVDS Input



Note1: Please follow PSWG.

Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

| Signal Name | Description  | Remark           |
|-------------|--------------|------------------|
| R7          | Red Data 7   | Red-pixel Data   |
| R6          | Red Data 6   |                  |
| R5          | Red Data 5   |                  |
| R4          | Red Data 4   |                  |
| R3          | Red Data 3   |                  |
| R2          | Red Data 2   |                  |
| R1          | Red Data 1   |                  |
| R0          | Red Data 0   |                  |
| G7          | Green Data 7 | Green-pixel Data |
| G6          | Green Data 6 |                  |
| G5          | Green Data 5 |                  |
| G4          | Green Data 4 |                  |
| G3          | Green Data 3 |                  |
| G2          | Green Data 2 |                  |
| G1          | Green Data 1 |                  |
| G0          | Green Data 0 |                  |

|  |  |   |
|--|--|---|
| B7<br>B6<br>B5<br>B4<br>B3<br>B2<br>B1<br>B0 | Blue Data 7<br>Blue Data 6<br>Blue Data 5<br>Blue Data 4<br>Blue Data 3<br>Blue Data 2<br>Blue Data 1<br>Blue Data 0 | Blue-pixel Data<br><br>For 6Bits LVDS input<br>MSB: B5 ; LSB: B0<br><br>For 8Bits LVDS input<br>MSB: B7 ; LSB: B0   |
| RxCLKIN                                      | LVDS Data Clock  | The typical frequency is 65MHz. The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high. |
| DE   | Data Enable Signal   | When the signal is high, the pixel data shall be valid to be displayed.   |

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.

## 6.5 Interface Timing

### 6.5.1 Timing Characteristics

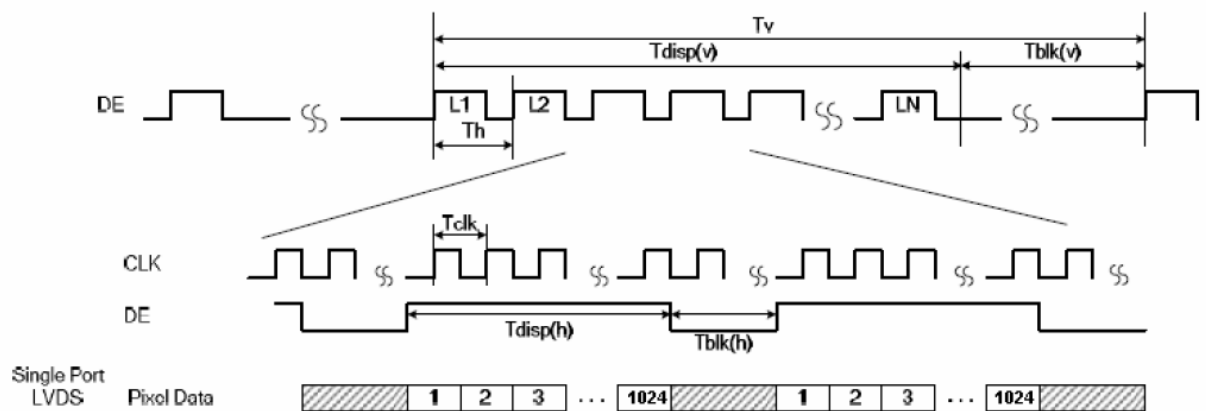
| Signal       | Parameter             |          | Symbol                | Min. | Typ. | Max. | Unit               |
|--------------|-----------------------|----------|-----------------------|------|------|------|--------------------|
| Clock Timing | Clock frequency       |          | 1/ T <sub>Clock</sub> | 50   | 65   | 80   | MHz                |
| Vsync Timing | Vertical<br>Section   | Period   | T <sub>V</sub>        | 776  | 806  | 1023 | T <sub>Line</sub>  |
|              |                       | Active   | T <sub>VD</sub>       | -    | 768  | -    |                    |
|              |                       | Blanking | T <sub>VB</sub>       | 8    | 38   | 255  |                    |
| Hsync Timing | Horizontal<br>Section | Period   | T <sub>H</sub>        | 1074 | 1344 | 2047 | T <sub>Clock</sub> |
|              |                       | Active   | T <sub>HD</sub>       | -    | 1024 | -    |                    |
|              |                       | Blanking | T <sub>HB</sub>       | 50   | 320  | 1023 |                    |
| Frame Rate   |                       |          | F                     | 50   | 60   | 75   | Hz                 |

Note: Frame rate is 60 Hz.

Note: DE mode.

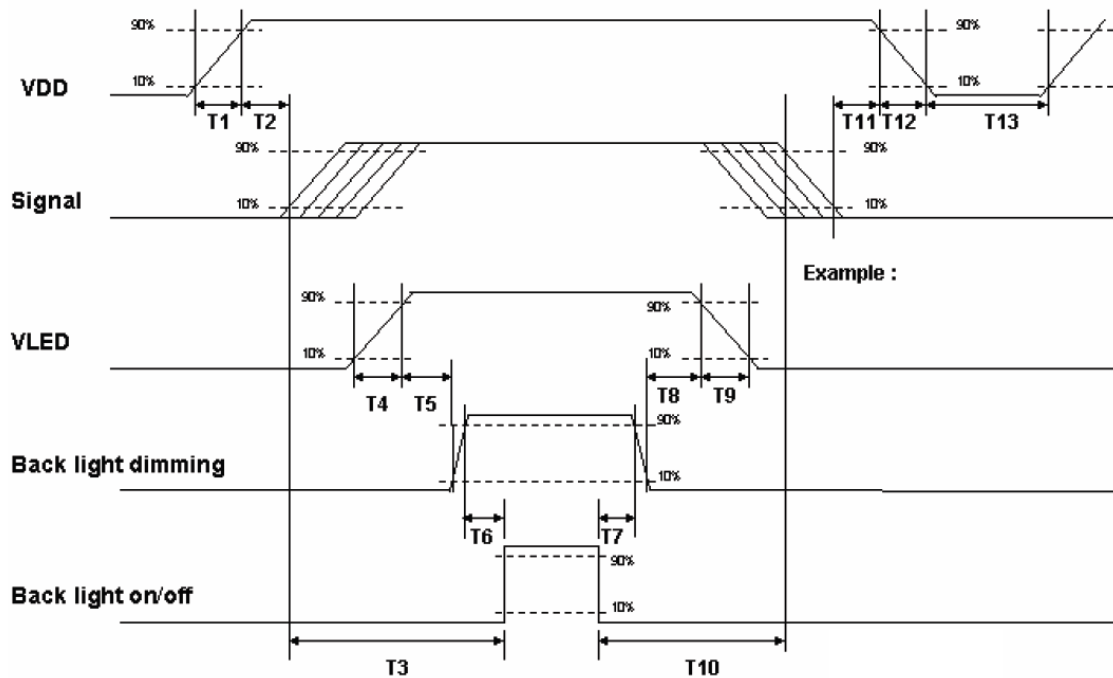
Note: Typical value refer to VESA STANDARD

### 6.5.2 Input Timing Diagram



## 6.6 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

| Parameter | Value |      |     | Units |
|-----------|-------|------|-----|-------|
|           | Min.  | Typ. | Max |       |
| T1        | 0.5   |      | 10  | ms    |
| T2        | 30    | 40   | 50  | ms    |
| T3        | 200   |      |     | ms    |
| T4        | 0.5   |      | 10  | ms    |
| T5        | 10    |      |     | ms    |
| T6        | 10    |      |     | ms    |
| T7        | 0     |      |     | ms    |
| T8        | 10    |      |     | ms    |
| T9        |       |      | 10  | ms    |
| T10       | 110   |      |     | ms    |
| T11       | 0     | 16   | 50  | ms    |
| T12       |       |      | 10  | ms    |
| T13       | 1000  |      |     | ms    |

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

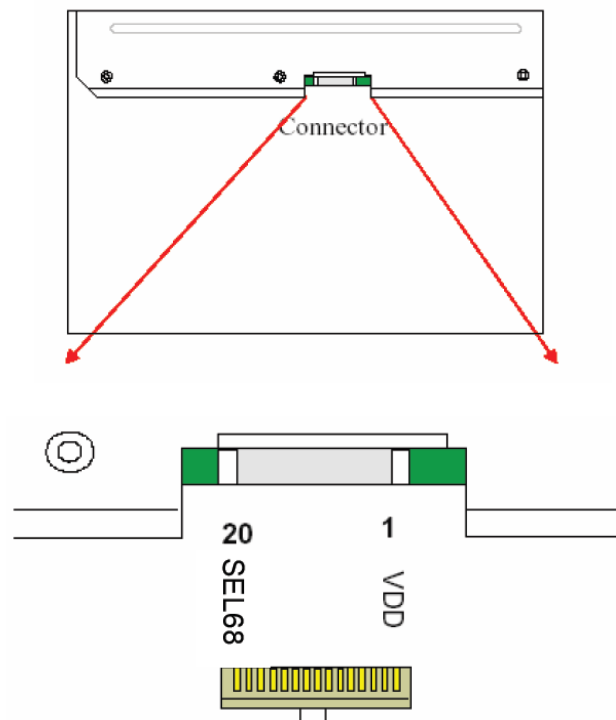
## 7.0 Connector & Pin Assignment

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

### 7.1 TFT LCD Module: LVDS interface connector

| Connector Name / Designation | Signal Connector      |
|------------------------------|-----------------------|
| Manufacturer                 | STM or compatible     |
| Connector Model Number       | MSB240420-E           |
| Mating Housing Part Number   | P240420 or compatible |

| Pin# | Signal Name | Pin# | Signal Name |
|------|-------------|------|-------------|
| 1    | VDD         | 2    | VDD         |
| 3    | GND         | 4    | REV         |
| 5    | Rin0-       | 6    | Rin0+       |
| 7    | GND         | 8    | Rin1-       |
| 9    | Rin1+       | 10   | GND         |
| 11   | Rin2-       | 12   | Rin2+       |
| 13   | GND         | 14   | ClkIN-      |
| 15   | ClkIN+      | 16   | GND         |
| 17   | Rin3-       | 18   | Rin3+       |
| 19   | NC/GND      | 20   | SEL68       |





## 7.2 Backlight Unit: LED Connector

For Upper / Lower connectors

| Pin No. | Symbol | I/O | Function                        | Remark |
|---------|--------|-----|---------------------------------|--------|
| 1       | VLED+  | P   | Power for LED backlight anode   | White  |
| 2       | VLED-  | P   | Power for LED backlight cathode | Black  |

LED Light Bar Connector is used for the integral backlight system. The recommended model is BHSR-02VS-1 manufactured by JST.

## 8. Reliability Test

Environment test conditions are listed as following table.

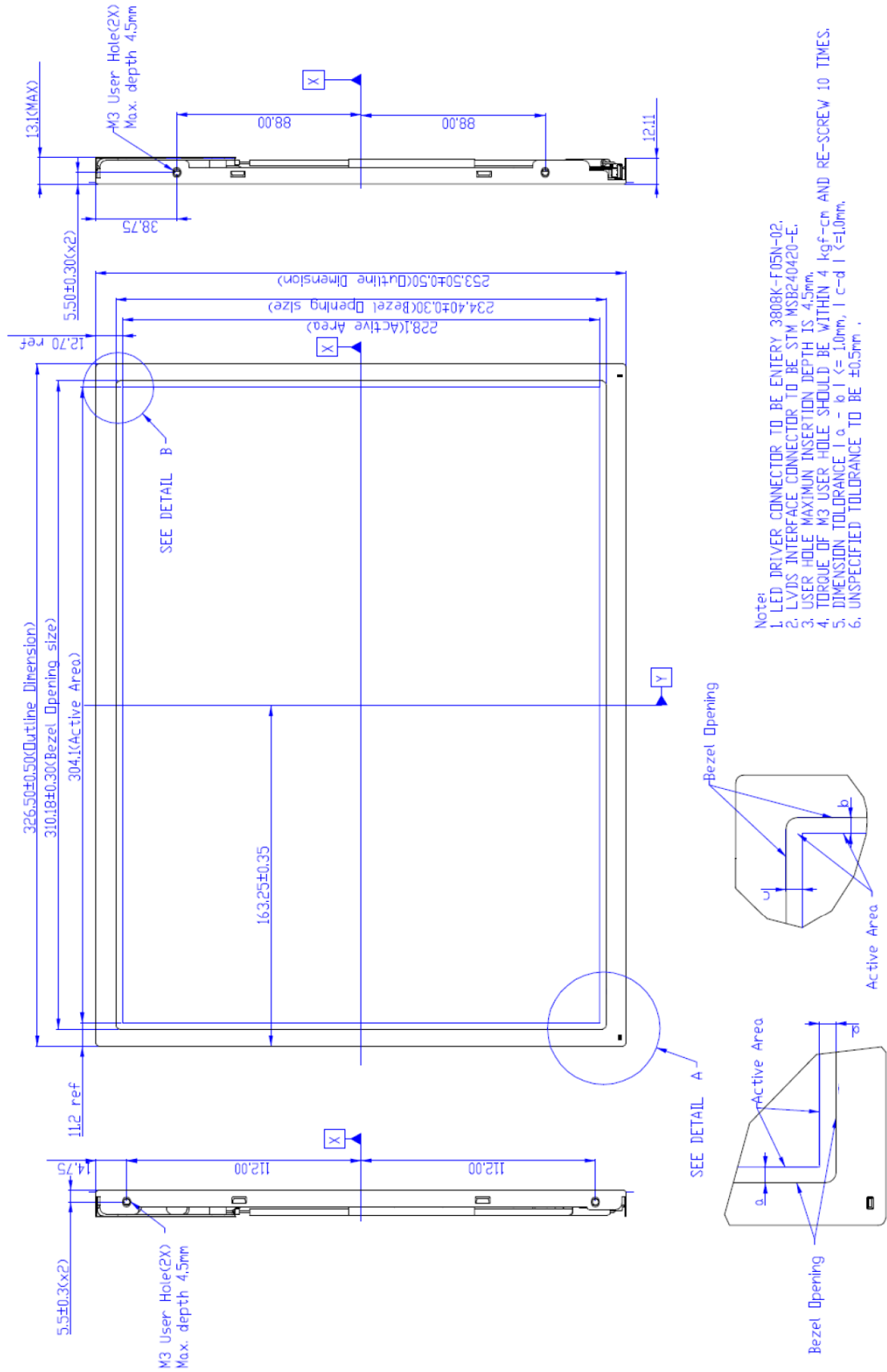
| Items                            | Required Condition  | Note |
|----------------------------------|---|------|
| Temperature Humidity Bias (THB)  | Ta= 50°C , 80%RH, 300hours  |      |
| High Temperature Operation (HTO) | Ta= 85°C , 50%RH, 300hours  | 3    |
| Low Temperature Operation (LTO)  | Ta= -30°C , 300hours  |      |
| High Temperature Storage (HTS)   | Ta= 85°C , 300hours   |      |
| Low Temperature Storage (LTS)    | Ta= -30°C , 300hours  |      |
| Drop Test                        | Height: 60 cm, package test   |      |
| Thermal Shock Test (TST)         | -20°C/30min, 60°C/30min, 100 cycles   | 1    |
| On/Off Test                      | On/10sec, Off/10sec, 30,000 cycles  |      |
| ESD (ElectroStatic Discharge)    | Contact Discharge: $\pm$ 8KV,<br>150pF(330 $\Omega$ ) 1sec, 9 points, 25<br>times/ point. | 2    |
|                                  | Air Discharge: $\pm$ 15KV, 150pF(330 $\Omega$ )<br>1sec 9 points, 25 times/ point.        | 2    |

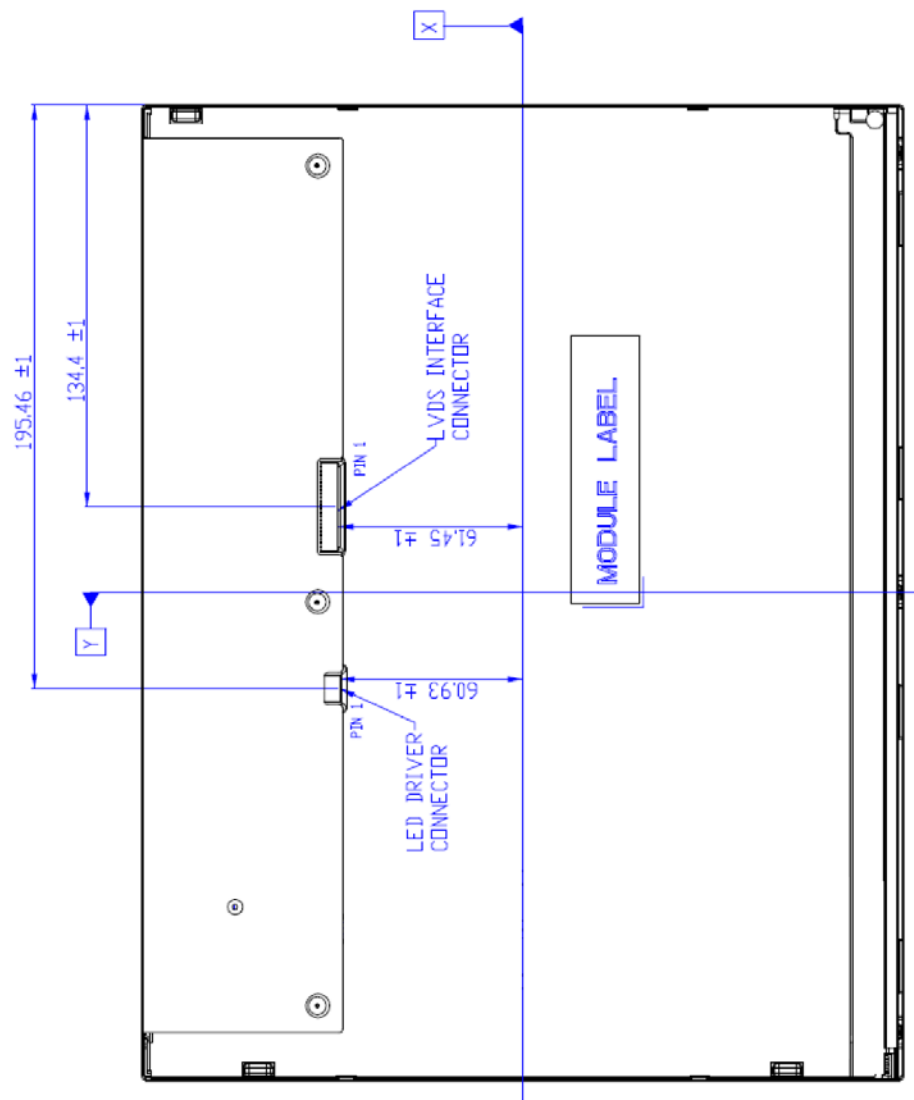
Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20°C to 60°C, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3: The test items are tested by open frame type chassis.

10. Mechanical Characteristic





NOTE: The Backlight connector is not shown