

# TFT-DISPLAY DATASHEET

AUO  
Model: G156HAN02.1

## BRIEF SPEC.:

Main Feature

Landscape

White LED Backlight

|                       |                          |
|-----------------------|--------------------------|
| Active Screen Area    | 344.16 x 193.59 (mm)     |
| Diagonal   Format     | 15.6"   16:9             |
| Resolution            | 1920 X 1080              |
| Colors                | 262K/ 16.7M (6/8 Bit)    |
| Backlight             | LED                      |
| Brightness            | 500 cd/m <sup>2</sup>    |
| LED Life Time         | 50K(h)                   |
| Interface             | LVDS                     |
| Viewing Angle         | 89/89 L/R 89/89          |
| Touchscreen           | No                       |
| Power Supply          | 3.3 V                    |
| Module Outline        | 363.8 x 215.9 x 9.3 (mm) |
| Operation Temperature | -20 ... +70 °C           |
| Storage Temperature   | -20... +70 °C            |
| Surface Treatment     | Anti-Glare, Hardness 3H  |



# Product Specification

G156HAN02.1

AU OPTRONICS CORPORATION

(✓) Preliminary Specifications

( ) Final Specifications

|            |                                           |
|------------|-------------------------------------------|
| Module     | 15.6" FHD Color TFT-LCD                   |
| Model Name | G156HAN02.1                               |
| Note       | LED backlight with driving circuit design |

|                           |       |
|---------------------------|-------|
| Customer                  | Date  |
| _____                     | _____ |
| Checked & Approved by     | Date  |
| _____                     | _____ |
| Customer's sign back page |       |

|                                                                 |                   |
|-----------------------------------------------------------------|-------------------|
| Approved by                                                     | Date              |
| <u>Sean Lin</u>                                                 | <u>12/20/2017</u> |
| Prepared by                                                     | Date              |
| <u>Sandy Su</u>                                                 | <u>12/20/2017</u> |
| General Display Business Division /<br>AU Optronics corporation |                   |



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## Record of Revision

| Version | Date       | Page | Old description            | New Description |
|---------|------------|------|----------------------------|-----------------|
| 0.0     | 2017/12/20 | All  | First Edition for Customer |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |
|         |            |      |                            |                 |



## 1. Handling Precautions

- 1) Since front polarizer is easily damaged, please be cautious and 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 soft cloth.
- 5) Since the panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.
- 6) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD Module.
- 7) Do not open nor modify the module assembly.
- 8) Do not press the reflector sheet at the back of the module to any direction.
- 9) In case if a module has to be put back into the packing container slot after 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) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
- 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.
- 13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
- 14) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
- 15) The data on this specification sheet is applicable when LCD module is placed in landscape position.
- 16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.



## 2. General Description

G156HAN02.1 is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD panel, a driver circuit, and LED backlight system. The screen format is intended to support the 16:9 FHD, 1920(H) x 1080(V) screen and 16.7M colors (RGB 8-bits )with LED backlight driving circuit. All input signals are eDP(Embedded DisplayPort) interface compatible.

G156HAN02.1 is designed for a display unit of notebook style personal computer and industrial machine.

## 2.1 General Specification

The following items are characteristics summary on the table at 25 °C condition:

| Items                            | Unit    | Specifications                                  |       |       |       |
|----------------------------------|---------|-------------------------------------------------|-------|-------|-------|
| Screen Diagonal                  | [mm]    | 15.6"                                           |       |       |       |
| Active Area                      | [mm]    | 344.16 x 193.59                                 |       |       |       |
| Resolution                       |         | 1920 x 3(RGB) x 1080                            |       |       |       |
| Pixel Pitch                      | [mm]    | 0.17925 x 0.17925                               |       |       |       |
| Pixel Arrangement                |         | R.G.B. Vertical Stripe                          |       |       |       |
| Display Mode                     |         | AHVA, Normally Black                            |       |       |       |
| Nominal Input Voltage VDD        | [Volt]  | +3.3 (Typ.)                                     |       |       |       |
| LCD Power Consumption            | [Watt]  | 2.11 (Max.)                                     |       |       |       |
| LED Power Consumption            | [Watt]  | 10.4 (Max.)                                     |       |       |       |
| Weight                           | [Grams] | 600 (Typ), 660 (Max)                            |       |       |       |
| Physical Size<br>Include bracket | [mm]    |                                                 | Min.  | Typ.  | Max.  |
|                                  |         | Length                                          | 363.3 | 363.8 | 364.3 |
|                                  |         | Width                                           | 215.4 | 215.9 | 216.4 |
|                                  |         | Thickness                                       |       | 8.8   |       |
| Electrical Interface             |         | 2 ch LVDS                                       |       |       |       |
| Surface Treatment                |         | Anti-glare, 3H                                  |       |       |       |
| Support Color                    |         | 16.7M colors ( RGB 8-bits)                      |       |       |       |
| Temperature Range                |         |                                                 |       |       |       |
| Operating                        | [°C]    | -20 to +70 (+70°C as panel surface temperature) |       |       |       |
| Storage (Non-Operating)          | [°C]    | -20 to +70                                      |       |       |       |
| RoHS Compliance                  |         | Yes                                             |       |       |       |

## 2.2 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/m²  | I <sub>LED</sub> =50mA<br>Center average | 400      | 500      | -      | 1, 2     |
| Luminance Uniformity                                 |             | %      | 9 Points                                 | 75       | 80       |        | 1, 2 , 3 |
| Contrast Ratio                                       |             | --     |                                          | 700      | 1000     | -      | 1, 4     |
| Response Time                                        |             | msec   | Rising + Falling                         | -        | 25       | 35     | 1, 5     |
| Viewing Angle                                        |             | degree | Horizontal (Right)<br>CR = 10 (Left)     | 80<br>80 | 89<br>89 | -<br>- | 1, 6     |
|                                                      |             |        | Vertical (Upper)<br>CR = 10 (Lower)      | 80<br>80 | 89<br>89 | -<br>- |          |
|                                                      |             |        |                                          |          |          |        |          |
|                                                      |             |        |                                          |          |          |        |          |
| Color /<br>Chromaticity<br>Coordinates<br>(CIE 1931) | Red         | Rx     | CIE 1931                                 | 0.589    | 0.639    | 0.689  | 4        |
|                                                      |             | Ry     |                                          | 0.283    | 0.333    | 0.383  |          |
|                                                      | Green       | Gx     |                                          | 0.252    | 0.302    | 0.352  |          |
|                                                      |             | Gy     |                                          | 0.574    | 0.624    | 0.674  |          |
|                                                      | Blue        | Bx     |                                          | 0.107    | 0.157    | 0.207  |          |
|                                                      |             | By     |                                          | 0.008    | 0.058    | 0.108  |          |
|                                                      | White       | Wx     |                                          | 0.263    | 0.313    | 0.363  |          |
|                                                      |             | Wy     |                                          | 0.279    | 0.329    | 0.379  |          |
|                                                      | Color Gamut |        |                                          | %        |          | -      |          |

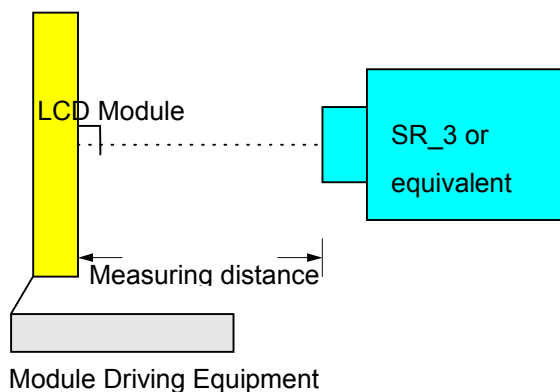
## Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR\_3 or equivalent)

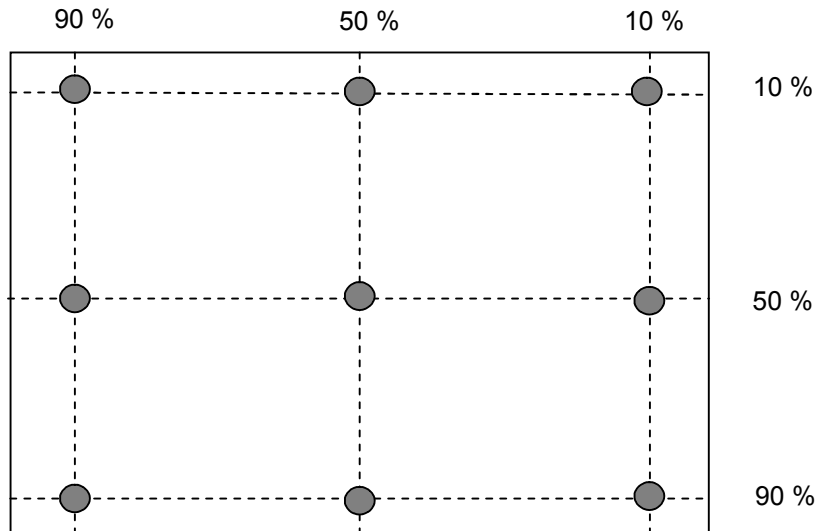
Aperture 1° with 50cm viewing distance

Test Point Center

Environment < 1 lux



## Note 2: 9 points position



**Note 3:** The luminance uniformity of 9 points is defined by dividing the maximum luminance values by the minimum test point luminance. And measured by TOPCON SR-3

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

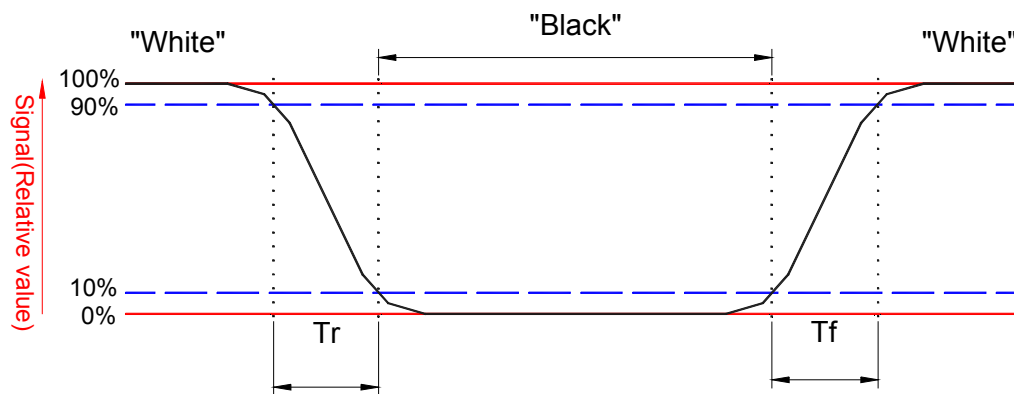
**Note 4 :** Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

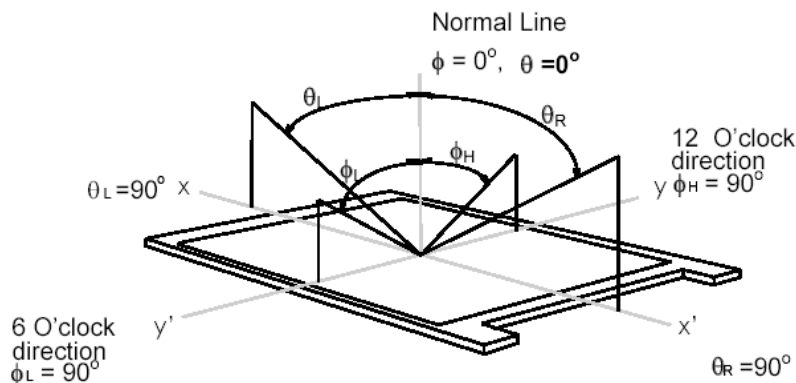
$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

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

The output signals of BM-7 or equivalent are measured when the input signals are changed from "Black" to "White" (falling time) and from "White" to "Black" (rising time), respectively. The response time interval between the 10% and 90% of amplitudes. Refer to figure as below.

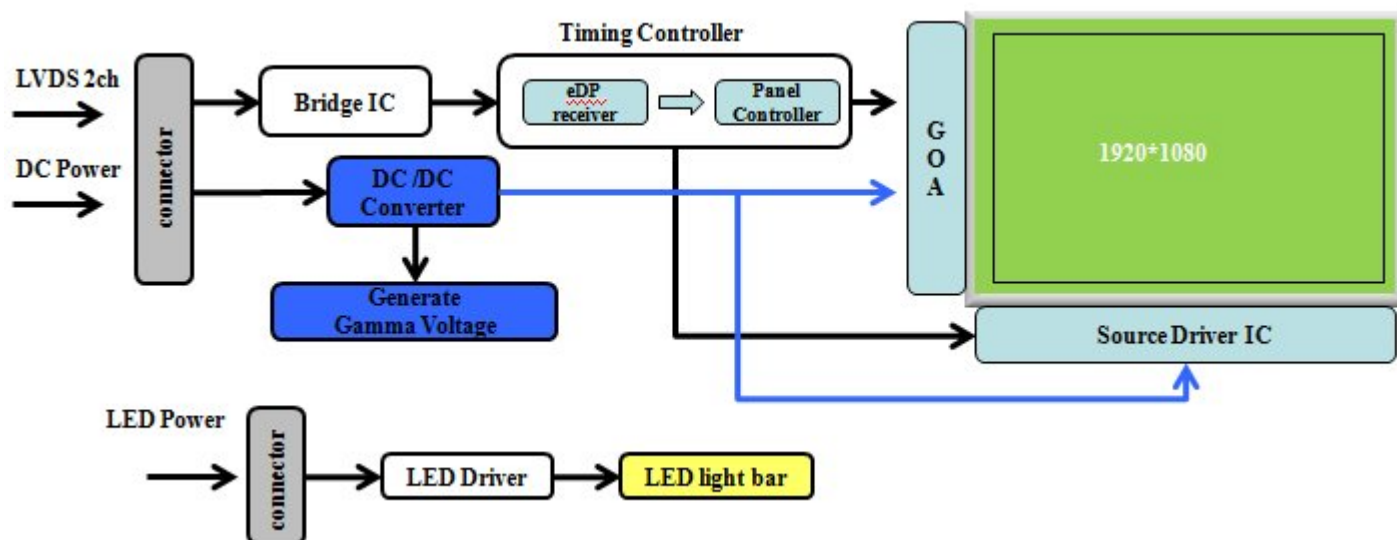

**Note 6:.** Definition of viewing angle

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



## 3. Functional Block Diagram

The following diagram shows the functional block of the 15.6 inches wide Color TFT/LCD module.



## 4. Absolute Maximum Ratings

An absolute maximum rating of the module is as following:

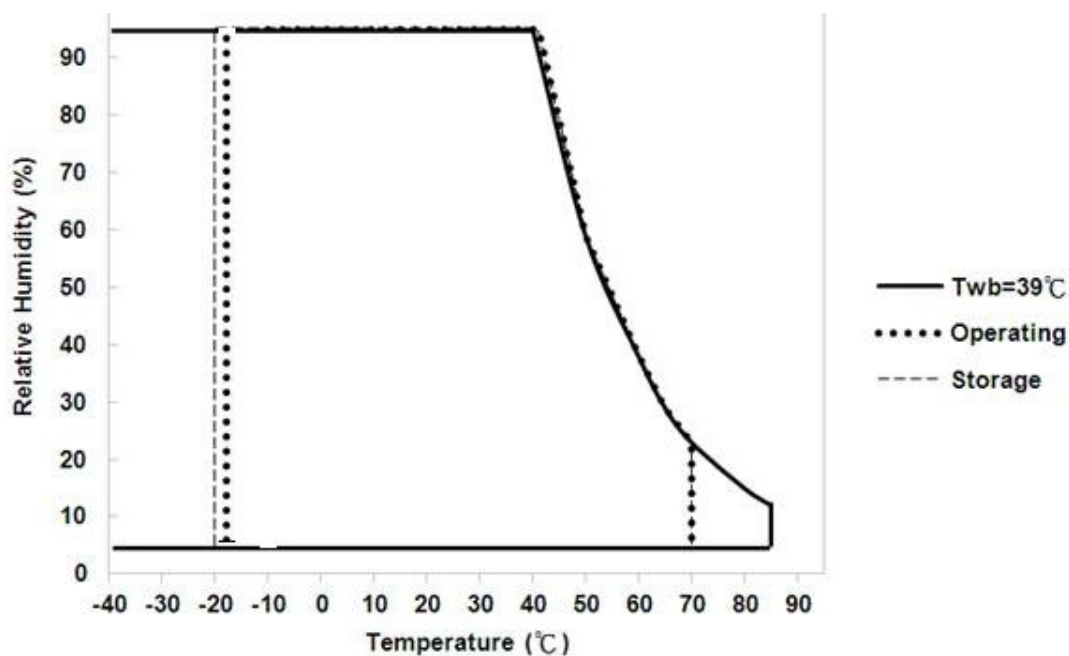
### 4.1 Absolute Ratings of TFT LCD Module

| Item            | Symbol | Min  | Max  | Unit   |
|-----------------|--------|------|------|--------|
| Logic/LCD Drive | Vin    | -0.3 | +4.0 | [Volt] |

### 4.2 Absolute Ratings of Environment

| Item                | Symbol | Min | Max | Unit  |
|---------------------|--------|-----|-----|-------|
| Operating           | TOP    | -20 | +70 | [°C]  |
| Operation Humidity  | HOP    | 5   | 95  | [%RH] |
| Storage Temperature | TST    | -20 | +70 | [°C]  |
| Storage Humidity    | HST    | 5   | 95  | [%RH] |

Note: Maximum Wet-Bulb should be 39 °C and no condensation.



## 5. Electrical Characteristics

### 5.1 TFT LCD Module

#### 5.1.1 Power Specification

Input power specifications are as follows;

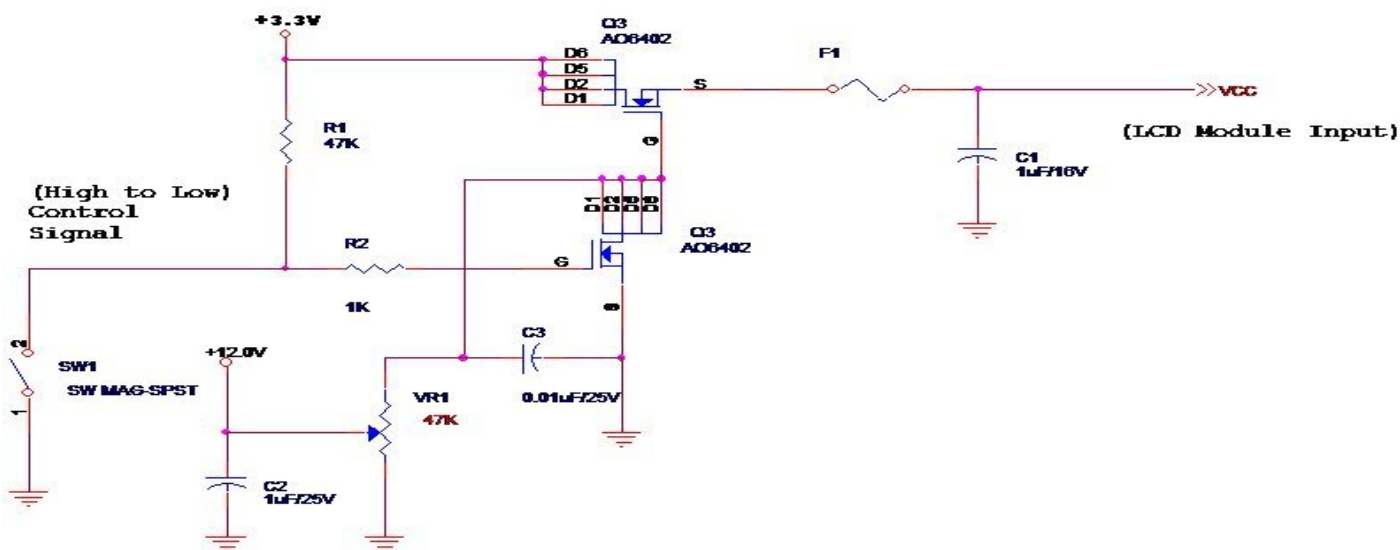
The power specification are measured under 25°C and frame frequency under 60Hz

| Symble | Parameter                                | Min | Typ  | Max  | Units       | Remark                                |
|--------|------------------------------------------|-----|------|------|-------------|---------------------------------------|
| VDD    | Logic/LCD Drive Voltage                  | 3.0 | 3.3  | 3.6  | [Volt]      |                                       |
| PDD    | VDD Power                                | -   | 1.75 | 2.11 | [Watt]      | All White Pattern (VDD=3.3V, at 60Hz) |
| IDD    | IDD Current                              | -   | 0.53 | 0.64 | [A]         | All White Pattern (VDD=3.3V, at 60Hz) |
| IRush  | Inrush Current                           | -   | -    | 2000 | [mA]        | Note 1                                |
| VDDrp  | Allowable Logic/LCD Drive Ripple Voltage | -   | -    | 100  | [mV]<br>p-p | All White Pattern (VDD=3.3V, at 60Hz) |

Note 1 : Maximum Measurement Condition : White Pattern at 3.3V driving voltage. ( $P_{max}=V_{3.3} \times I_{white}$ )

Typical Measurement Condition: Mosaic Pattern

Note 2 : Measure Condition

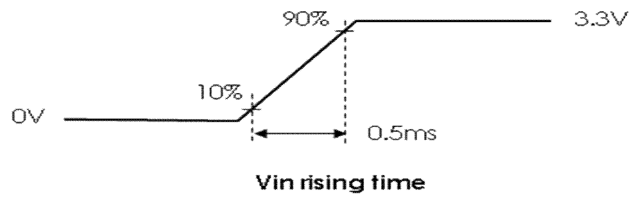




# Product Specification

G156HAN02.1

AU OPTRONICS CORPORATION



## 5.1.2 LVDS DC Signal Electrical Characteristics

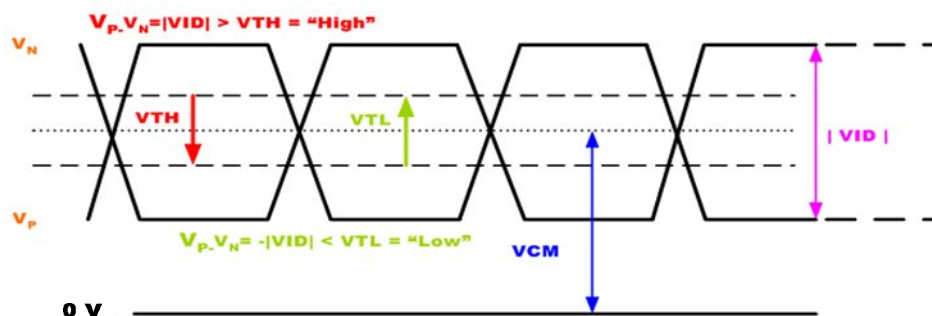
| Symbol           | Item                                   | Min. | Typ. | Max. | Unit | Remark                                     |
|------------------|----------------------------------------|------|------|------|------|--------------------------------------------|
| V <sub>TH</sub>  | Differential Input High Threshold      |      |      | +100 | [mV] | V <sub>CM</sub> =1.2V                      |
| V <sub>TL</sub>  | Differential Input Low Threshold       | -100 |      |      | [mV] | V <sub>CM</sub> =1.2V                      |
| V <sub>ID</sub>  | Input Differential Voltage             | 100  |      | 600  | [mV] |                                            |
| V <sub>ICM</sub> | Differential Input Common Mode Voltage | 1.0  | 1.2  | 1.5  | [V]  | V <sub>TH</sub> /V <sub>TL</sub> =+/-100mV |

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

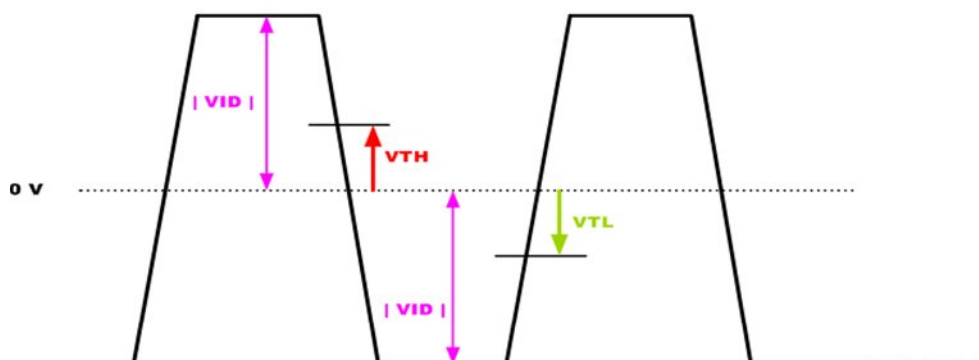
Note: LVDS Signal Waveform.

$V_P - V_N = |V_{ID}| > V_{TH} = \text{"High"}$   
 $V_P - V_N = -|V_{ID}| < V_{TL} = \text{"Low"}$

### Single-end Signal



### Differential Signal



## 5.2 Backlight Unit

### 5.2.1 LED Backlight Unit : Driver Connector

| Connector Name / Designation | Lamp Connector               |
|------------------------------|------------------------------|
| Manufacturer                 | Entery                       |
| Connector Model Number       | 3808K-F05N-02 or compatible  |
| Mating Model Number          | H208K-D05N-22B or compatible |

| Pin No. | Symbol  | Description  |
|---------|---------|--------------|
| Pin1    | VCC     | 12V input    |
| Pin2    | GND     | GND          |
| Pin3    | On/OFF  | 5V-ON,0V-OFF |
| Pin4    | Dimming | PWM/Analog   |
| Pin5    | NA      | NA           |

### 5.2.3 Parameter guideline for LED

Following characteristics are measured under a stable condition using an inverter at 25°C (Room Temperature):

#### LED characteristics

| Parameter                   | Symbol | Min    | Typ | Max  | Units  | Condition                     |
|-----------------------------|--------|--------|-----|------|--------|-------------------------------|
| Backlight Power Consumption | PLED   | -      | 8.3 | 10.4 | [Watt] | (Ta=25°C), Note 1<br>Vin =12V |
| LED Life-Time               | N/A    | 50,000 | -   | -    | Hour   | (Ta=25°C), Note 2,3           |

**Note 1:** Ta means ambient temperature of TFT-LCD module.

**Note 2:** If G156HAN02.1 module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

**Note 3:** Operating life means brightness goes down to 50% initial brightness. Min. operating life time is estimated data.



## Backlight input signal characteristics

| Parameter                      | Symbol  | Min  | Typ | Max  | Units  | Remark                                           |
|--------------------------------|---------|------|-----|------|--------|--------------------------------------------------|
| LED Power Supply               | VLED    | 10.8 | 12  | 13.2 | [Volt] | Define as<br>Connector<br>Interface<br>(Ta=25°C) |
| LED Enable Input<br>High Level | VLED_EN | 2.5  | --  | 5.5  | [Volt] |                                                  |
| LED Enable Input<br>Low Level  |         | 0    | --  | 0.7  | [Volt] |                                                  |
| PWM Logic Input<br>High Level  | VPWM_EN | 2.5  | --  | 5.5  | [Volt] |                                                  |
| PWM Logic Input<br>Low Level   |         | 0    | --  | 0.7  | [Volt] |                                                  |
| PWM Input Frequency            | FPWM    | 200  | 1K  | 15K  | Hz     |                                                  |
| PWM Duty Ratio                 | Duty    | 10   | --  | 100  | %      |                                                  |

**Note 1 :** Recommended system pull up/down resistor no bigger than 10kohm.

**Note 2 :** If the PWM duty ratio(min) is set between 5% to 1% , the PWM input frequency should be set below 1KHz . The brightness-duty characteristic might not be able to keep in it's linearity if the dimming control is operated in 1% to 5% range.





## 6. 3 Signal Description

The module uses a LVDS receiver embedded in AUO's ASIC. LVDS is a differential signal technology for LCD interface and a high-speed data transfer device.

### 6.3.1 TFT LCD Module: LVDS Connector

|                   |              |                        |                |
|-------------------|--------------|------------------------|----------------|
| TFT-LCD Connector | Manufacturer | P-TWO                  | STM            |
|                   | Part Number  | 187034-3009            | MSBKT2407P30HB |
| Mating Connector  | Manufacturer | JAE or Equivalent      |                |
|                   | Part Number  | FI-X30HL (Locked Type) |                |

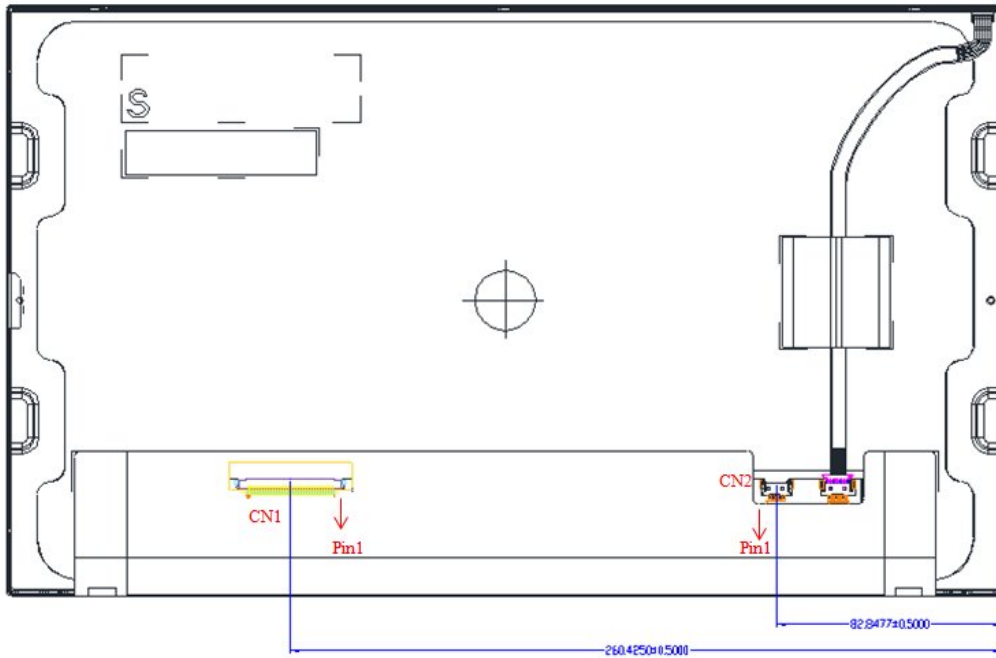
| PIN # | Symbol  | Description                                         | Remark |
|-------|---------|-----------------------------------------------------|--------|
| 1     | RxO0-   | Negative LVDS differential data input (Odd data)    |        |
| 2     | RxO0+   | Positive LVDS differential data input (Odd data)    |        |
| 3     | RxO1-   | Negative LVDS differential data input (Odd data)    |        |
| 4     | RxO1+   | Positive LVDS differential data input (Odd data)    |        |
| 5     | RxO2-   | Negative LVDS differential data input (Odd data)    |        |
| 6     | RxO2+   | Positive LVDS differential data input (Odd data)    |        |
| 7     | GND     | Ground                                              |        |
| 8     | RxOCLK- | Negative LVDS differential clock input (Odd clock)  |        |
| 9     | RxOCLK+ | Positive LVDS differential clock input (Odd clock)  |        |
| 10    | RxO3-   | Negative LVDS differential data input (Odd data)    |        |
| 11    | RxO3+   | Positive LVDS differential data input (Odd data)    |        |
| 12    | RxE0-   | Negative LVDS differential data input (Even data)   |        |
| 13    | RxE0+   | Positive LVDS differential data input (Even data)   |        |
| 14    | GND     | Ground                                              |        |
| 15    | RxE1-   | Negative LVDS differential data input (Even data)   |        |
| 16    | RxE1+   | Positive LVDS differential data input (Even data)   |        |
| 17    | GND     | Ground                                              |        |
| 18    | RxE2-   | Negative LVDS differential data input (Even data)   |        |
| 19    | RxE2+   | Positive LVDS differential data input (Even data)   |        |
| 20    | RxECLK- | Negative LVDS differential clock input (Even clock) |        |
| 21    | RxECLK+ | Positive LVDS differential clock input (Even clock) |        |
| 22    | RxE3-   | Negative LVDS differential data input (Even data)   |        |
| 23    | RxE3+   | Positive LVDS differential data input (Even data)   |        |
| 24    | GND     | Must Connect to GND                                 |        |
| 25    | NC      | No connection (for AUO test only. Do not connect)   |        |
| 26    | NC      | No connection (for AUO test only. Do not connect)   |        |
| 27    | NC      | No connection (for AUO test only. Do not connect)   |        |
| 28    | VDD     | Power Supply Input Voltage                          |        |

|    |     |                            |  |
|----|-----|----------------------------|--|
| 29 | VDD | Power Supply Input Voltage |  |
| 30 | VDD | Power Supply Input Voltage |  |

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

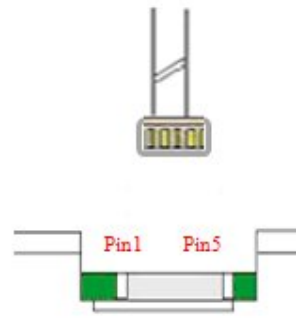
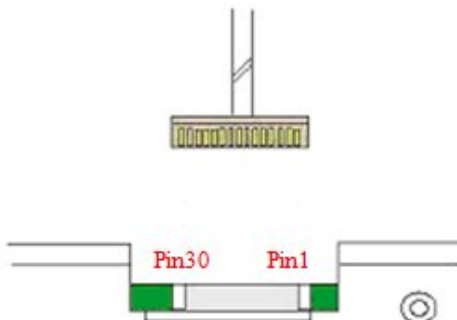
Note 2: High stands for “3.3V”, Low stands for “0V”, NC means “No Connection”.

## 6.3.2 Connector Illustration

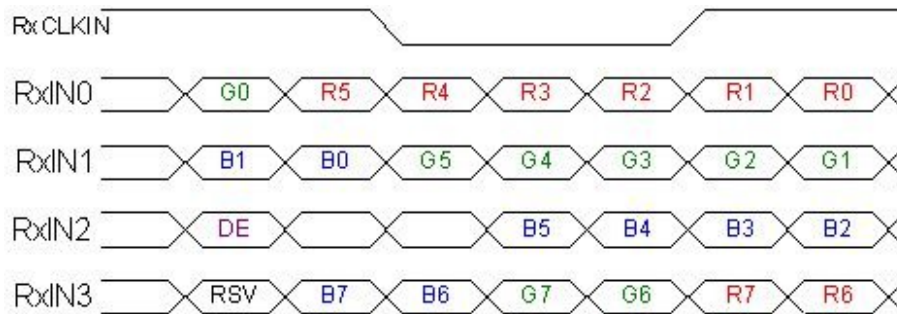


LVDS (CN1):

BLU Power in (CN2):



## 6.4 The Input Data Format



Note1: Please follow PSWG.

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

| Signal Name                                  | Description                                                                                                                  | Remark                                                                                                             |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| R7<br>R6<br>R5<br>R4<br>R3<br>R2<br>R1<br>R0 | Red Data 7<br>Red Data 6<br>Red Data 5<br>Red Data 4<br>Red Data 3<br>Red Data 2<br>Red Data 1<br>Red Data 0                 | Red-pixel Data<br><br>For 8Bits LVDS input<br>MSB: R7 ; LSB: R0<br><br>For 6Bits LVDS input<br>MSB: R5 ; LSB: R0   |
| G7<br>G6<br>G5<br>G4<br>G3<br>G2<br>G1<br>G0 | Green Data 7<br>Green Data 6<br>Green Data 5<br>Green Data 4<br>Green Data 3<br>Green Data 2<br>Green Data 1<br>Green Data 0 | Green-pixel Data<br><br>For 8Bits LVDS input<br>MSB: G7 ; LSB: G0<br><br>For 6Bits LVDS input<br>MSB: G5 ; LSB: G0 |
| 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 8Bits LVDS input<br>MSB: B7 ; LSB: B0<br><br>For 6Bits LVDS input<br>MSB: B5 ; LSB: B0  |
| RxCLKIN                                      | LVDS Data Clock                                                                                                              |                                                                                                                    |
| 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

Basically, interface timings should match the 1920x1080 /60Hz manufacturing guide line timing.

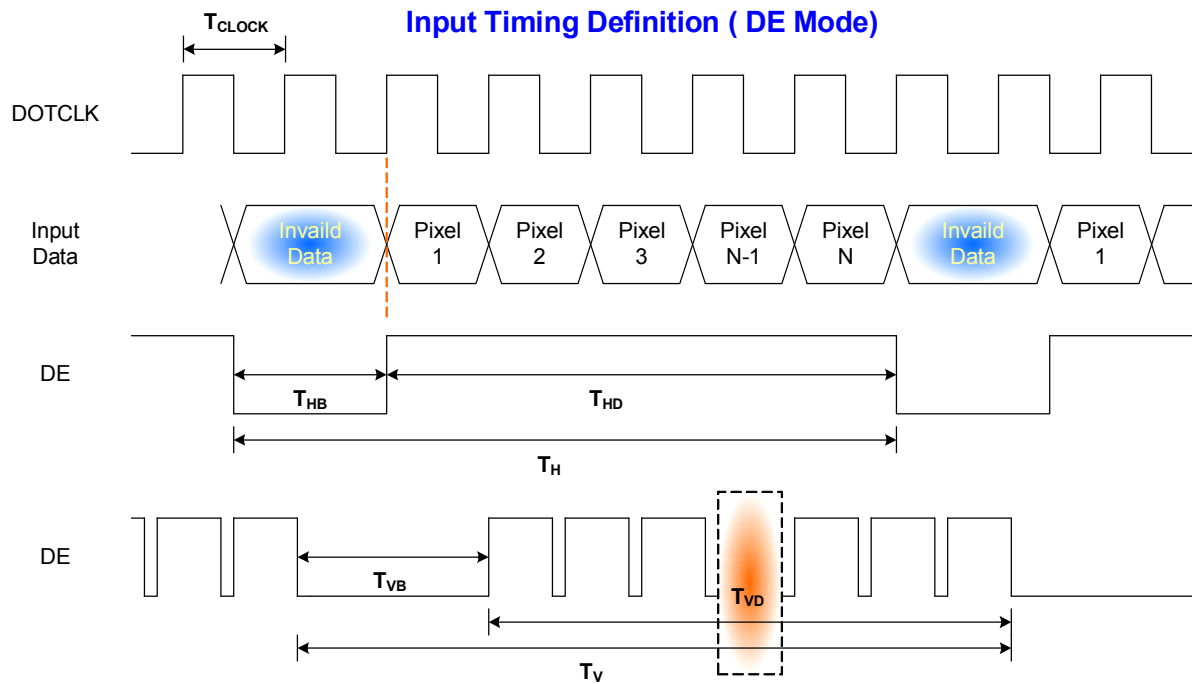
| Parameter             |          | Symbol                | Min. | Typ. | Max. | Unit               |
|-----------------------|----------|-----------------------|------|------|------|--------------------|
| Frame Rate            |          | -                     | -    | 60   | -    | Hz                 |
| Clock frequency       |          | 1/ T <sub>Clock</sub> | 137  | 141  | 149  | MHz                |
| Vertical<br>Section   | Period   | T <sub>V</sub>        | 1090 | 1116 | 1190 | T <sub>Line</sub>  |
|                       | Active   | T <sub>VD</sub>       | 1080 |      |      |                    |
|                       | Blanking | T <sub>VB</sub>       | 10   | 36   | 110  |                    |
| Horizontal<br>Section | Period   | T <sub>H</sub>        | 2100 | 2104 | 2280 | T <sub>Clock</sub> |
|                       | Active   | T <sub>HD</sub>       | 1920 |      |      |                    |
|                       | Blanking | T <sub>HB</sub>       | 180  | 184  | 360  |                    |

Note: The maximum Frame Rate  $< 149\text{MHz} / [(V_{\text{Period}}) * (H_{\text{Period}})]$

Note: Support DE mode only.

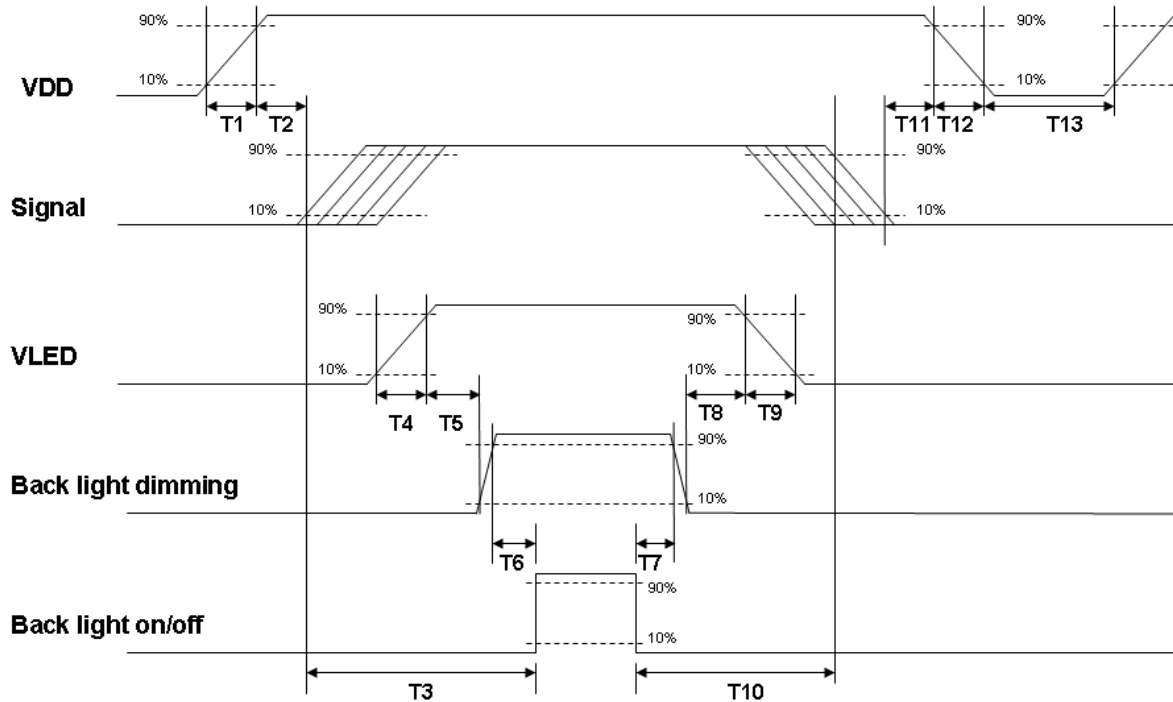
Note: Typical value refer to VESA STANDARD

### 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. Panel Reliability Test

| Items                      | Required Condition                                                                                                                              | Note     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Temperature Humidity Bias  | Ta= 50°C, 80%RH, 300h                                                                                                                           | Note 1,2 |
| High Temperature Operation | Ta= 70°C, Dry, 300h (For panel surface temp.)                                                                                                   |          |
| Low Temperature Operation  | Ta= -20°C, 300h                                                                                                                                 |          |
| High Temperature Storage   | Ta= 70°C, 300h                                                                                                                                  |          |
| Low Temperature Storage    | Ta= -20°C, 300h                                                                                                                                 |          |
| Thermal Shock Test         | Ta= -20°Cto 60°C, Duration at 30 min, 100 cycles                                                                                                |          |
| Vibration                  | Test method: Non-Operation<br>Acceleration: 1.5 G<br>Frequency: 10 - 200 -10Hz<br>Sweep: Sine wave vibration;<br>30 minutes each axis (X, Y, Z) |          |
| Mechanical Shock           | Test method: Non-Operation<br>Acceleration: 50 G; Wave: Half-sine<br>Active time: 20 ms<br>Direction: ±X,±Y,±Z (one time for each axis)         |          |
| Drop Test                  | Height: 46 cm, package test                                                                                                                     |          |
| ESD                        | Contact : ±8 KV<br>Air : ±15 KV                                                                                                                 | Note 1   |

**Note 1:** According to EN 61000-4-2 , ESD class B: Some performance degradation allowed. Self-recoverable.  
No data lost, No hardware failures.

**Note 2:**

- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.
- No function failure occurs. Mura shall be ignored after high temperature reliability test



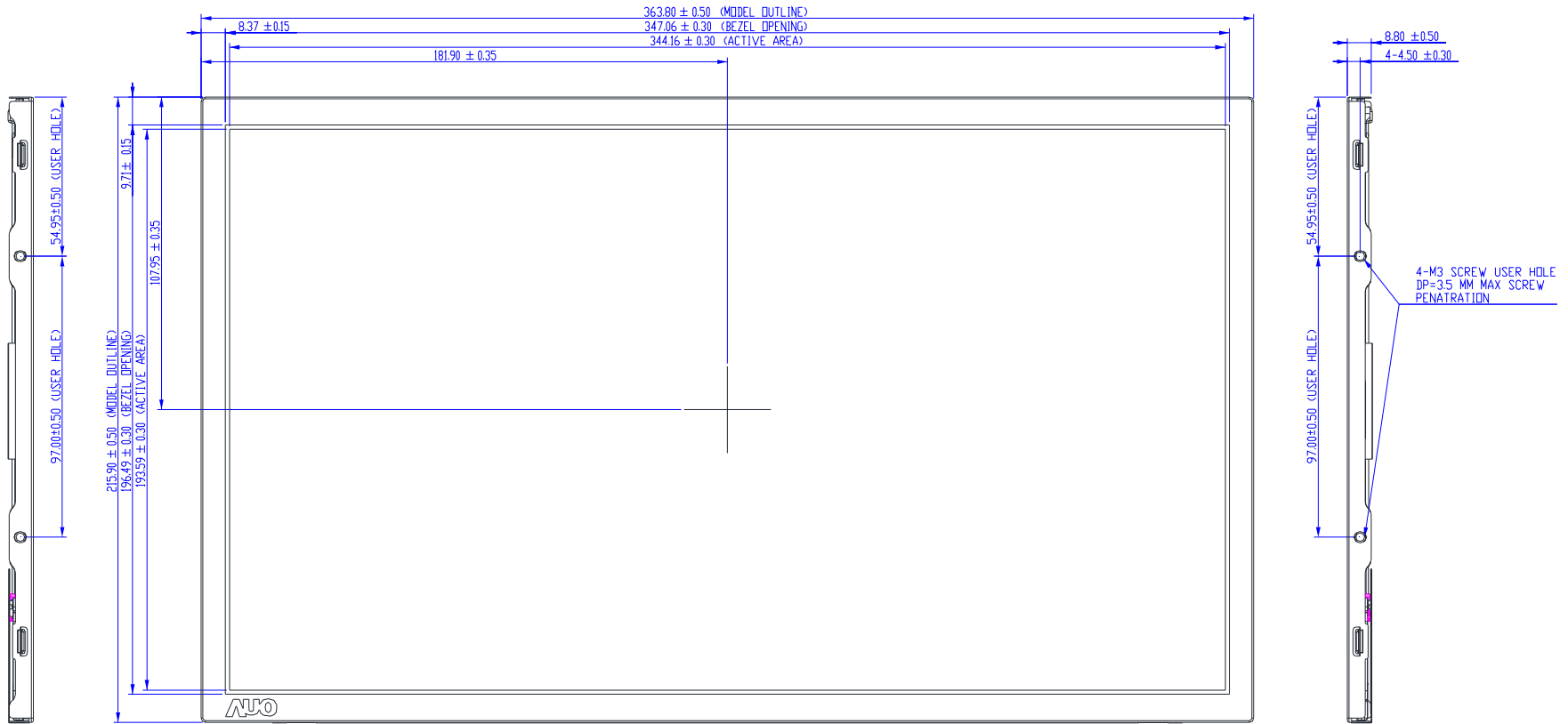
# Product Specification

G156HAN02.1

AU OPTRONICS CORPORATION

## 8. Mechanical Characteristics

### 8.1 LCM Outline Dimension (Front View)



#### Note:

1. Preliminary drawing for reference only.
2. Tolerance without specified to be +/-0.5mm.
3. Torque of M3 user hole should be within 4Kg-cm and re-screw 10times.

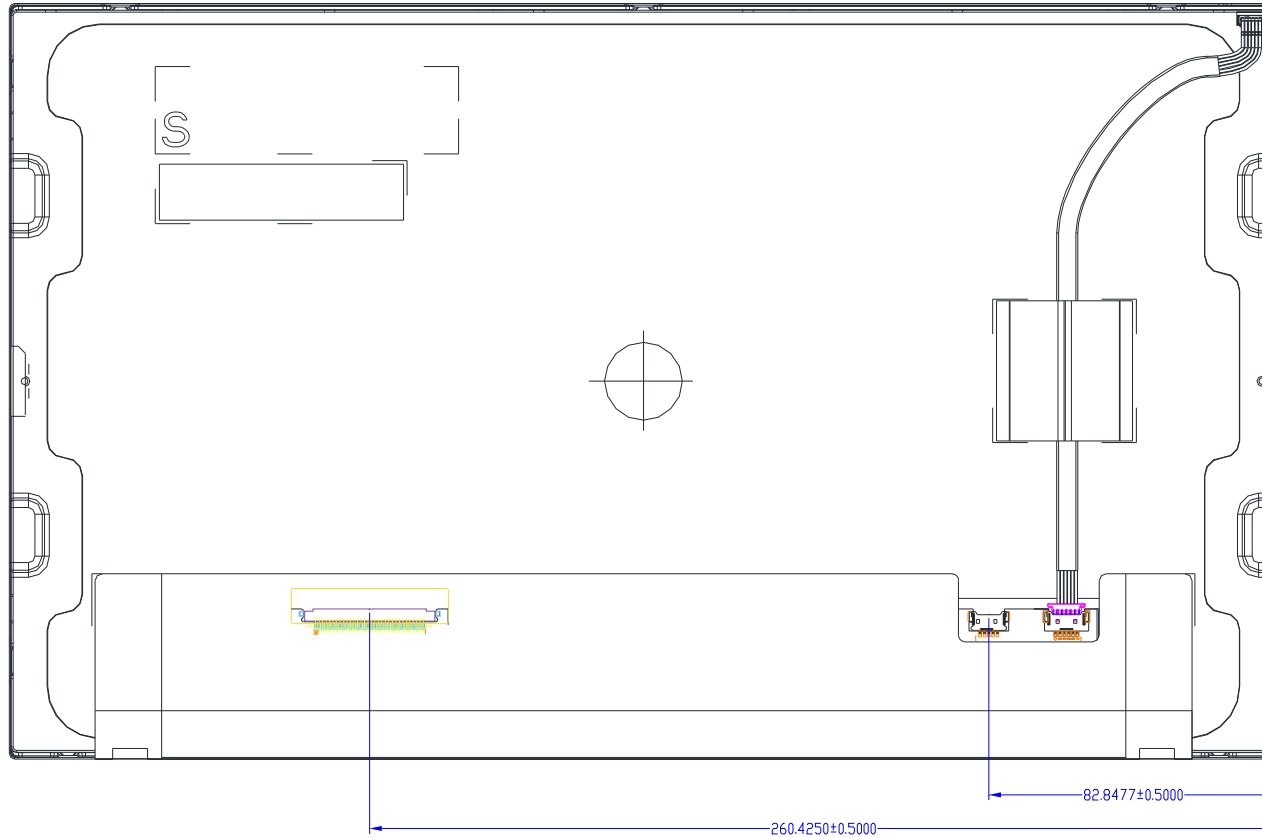
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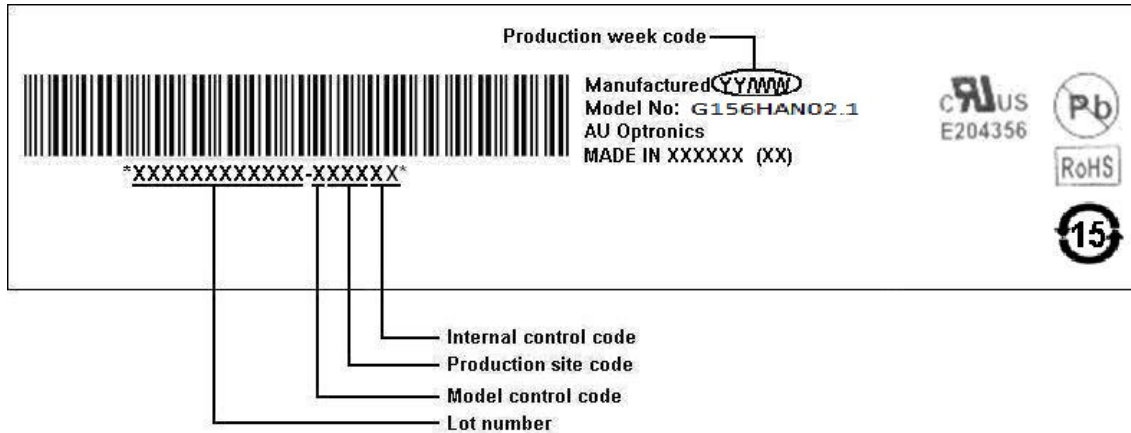


## 8.2 LCM Outline Dimension (Rear View)



## 9. Label and Packaging

### 9.1 Shipping Label (on the rear side of TFT-LCD display)



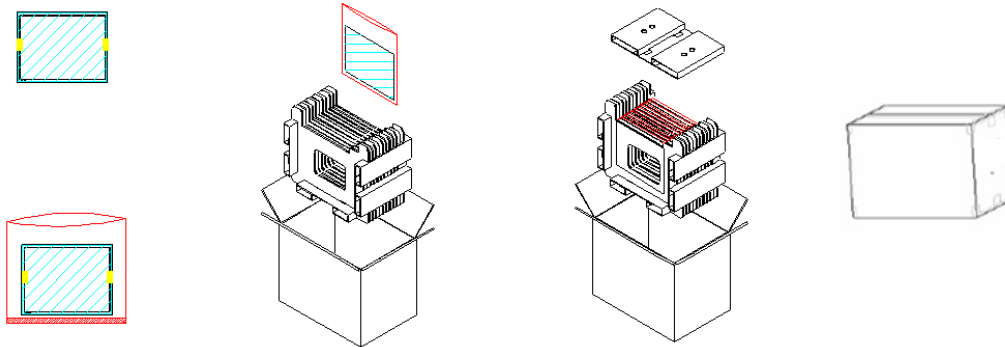
*Note 1:* For Pb Free products, AUO will add  for identification.

*Note 2:* For RoHS compatible products, AUO will add  for identification.

*Note 3:* For China RoHS compatible products, AUO will add  for identification.

*Note 4:* The Green Mark will be presented only when the green documents have been ready by AUO Internal Green Team.

## 9.2 Carton Package



Max capacity : 16 TFT-LCD module per carton

Max weight: 13.2 Kg per carton

Outside dimension of carton: 450mm(L)\*375mm(W)\*319mm(H)

Pallet size : 1150 mm \* 910 mm \* 132mm

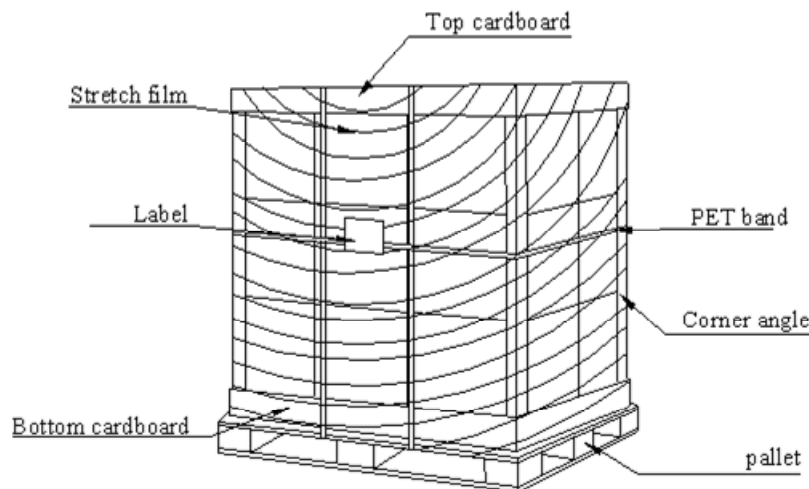
### Box stacked

Module by air : (2 \*3) \*4 layers , one pallet put 24 boxes , total 384pcs module

Module by sea : (2 \*3) \*4 layers+(2 \*3) \*1 layers , two pallet put 30 boxes , total 480pcs module

Module by sea\_HQ : (2 \*3) \*4 layers+(2 \*3) \*2 layers , two pallet put 42 boxes , total 576 pcs module

## 9.3 Shipping Package of Palletizing Sequence





## 10. Safety

### 10.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

### 10.2 Materials

#### 10.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

#### 10.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

### 10.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

### 10.4 National Test Lab Requirement

The display module will satisfy all requirements for compliance to:

UL 60950-1 second edition

U.S.A. Information Technology Equipment

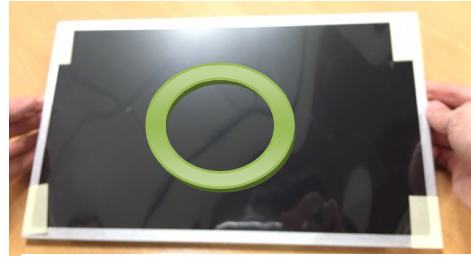
## 11. Handling guide

This is a LCD model, and please be cautious when pulling it out of package or assembling it onto platform. Careless handlings, e.g. twist, bending, pressing, or collision, will result malfunction of LCD models.

### (1) Handling method notice



Do not lift and hold the panel with Single hand at right or left side from tray.



Lift and hold the panel up with both hands from tray.

### (2) On the table notice



Do not press edge of panel to avoid glass broken.

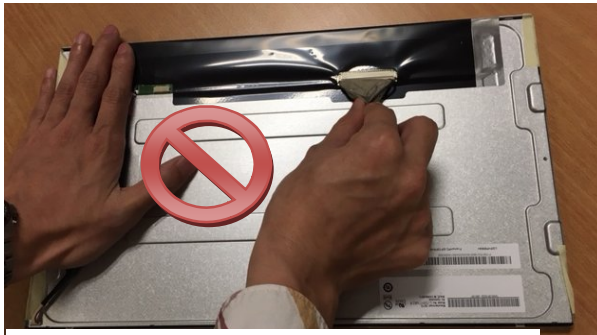


Do not press the surface of the panel to avoid the glass broken or polarizer scratch.

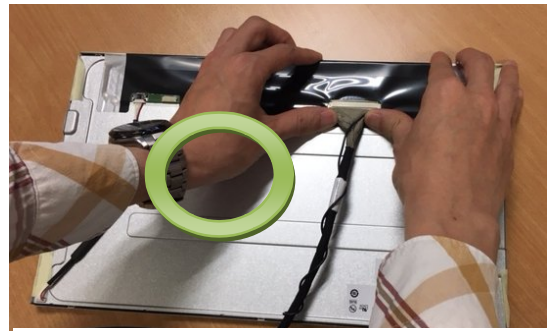


Do not put anything or tool on the panel to avoid the glass broken or polarizer scratch.

### (3) Cable assembly notice



Do not insert the connector with single hand and touching the PCBA.



Insert the connector by pushing right and left edge.