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Datasheet

AUO

G229HAN01.0

UP-02-185



Product Specification

G229HAN01.0

AU OPTRONICS CORPORATION

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- () Preliminary Specification
- (V) Final Specification

| | |
|-------------------|---------------------|
| Module | 22.9" Color TFT-LCD |
| Model Name | G229HAN01.0 |

| Customer | Date |
|---|-------|
| _____ | _____ |
| Checked & Approved by | |
| _____ | _____ |
| Note: This Specification is subject to change without notice. | |

| Approved by | Date |
|--|-------------------|
| <u>Crystal Hsieh</u> | <u>2019/04/19</u> |
| Prepared by | |
| <u>HsinYin Lee</u> | <u>2019/04/19</u> |
| General Display Business Unit/ AU Optronics corporation | |

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Record of Revision

| Version | Date (yyyy/m/d) | Page | Old description | New Description |
|---------|--------------------|------|-----------------|---|
| 1.0 | 2019/03/13 | All | - | Final spec first released |
| 2.0 | 2019/04/19 | p.8 | - | Update Optical-contrast ratio spec min. |
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1.0 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 it was taken out from the container, do not press the center of LED lightbar 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 momentarily. While 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 (IEC60950-1 or UL60950-1), or be applied exemption.



2.0 General Description

This specification applies to the 22.9 inch-wide Color AHVA (IPS-like) TFT-LCD Module G229HAN01.0. The display supports the FHD [1920(H) x 165(V)] screen format and 16.7M colors (True 8 bit). All input signals are LVDS interface compatible.

2.1 Display Characteristics

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

| ITEMS | Unit | SPECIFICATIONS |
|---|----------------------|---------------------------------------|
| Screen Diagonal | [mm] | 581.01(22.9") |
| Active Area | [mm] | 578.88 (H) x 49.7475 (V) |
| Pixels H x V | | 1920x165 |
| Pixel Pitch | [um] | 301.5 × 301.5 |
| Pixel Arrangement | | R.G.B. Vertical Stripe |
| Display Mode | | AHVA mode, Normally black |
| White Luminance (Center) | [cd/m ²] | 500 (Typ.) |
| Contrast Ratio | | 1000 (Typ.) |
| Optical Response Time | [msec] | 25 |
| Nominal Input Voltage VDD | [Volt] | 5 (Typ) |
| Power Consumption (VDD line + LED line) | [Watt] | 7.53 |
| Weight | [Grams] | 460 (Typ) |
| Physical Size | [mm] | 587.08 (H) x 62.05 (V) x10.21 (D) Typ |
| Electrical Interface | | Single LVDS |
| Support Color | | 16.7M colors, True 8 bit |
| Surface Treatment | | Anti-Glare, 3H |
| RoHS Compliance | | RoHS Compliance |
| Temperature Range Operating | [°C] | 0~ 50 |
| Storage (Shipping) | [°C] | -20~ 60 |

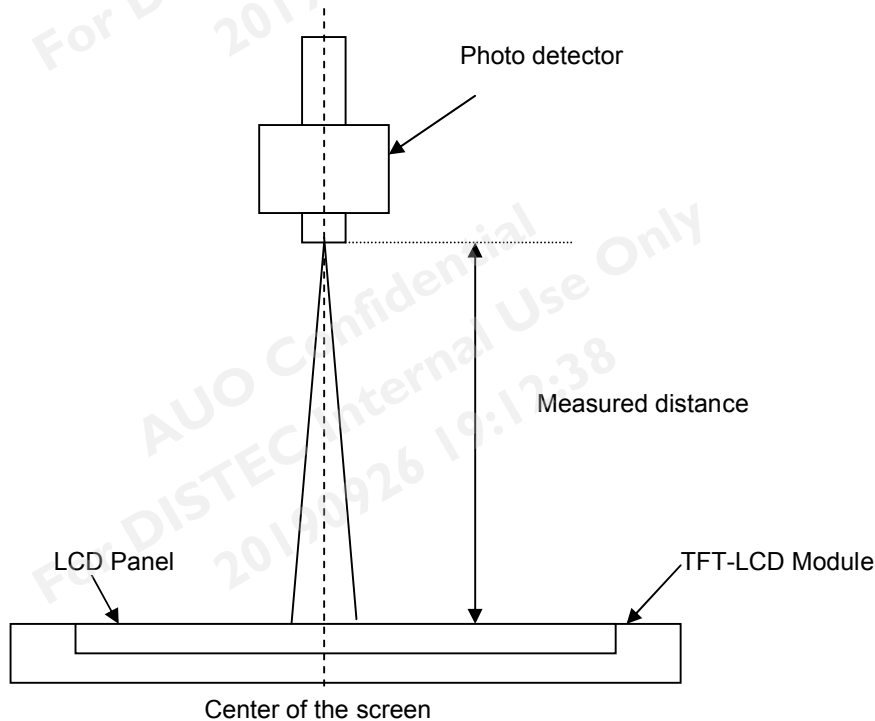
2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 °C:

| Item | Unit | Conditions | Min. | Typ. | Max. | Note |
|---|----------------------|--------------------------------|-------|-------|-------|------|
| Viewing Angle | [degree] | Horizontal (Right) CR >10 | 79 | 89 | - | 2 |
| | | (Left) | 79 | 89 | - | |
| | | Vertical (Up) CR > 10 | 79 | 89 | - | |
| | | (Down) | 79 | 89 | - | |
| Contrast ratio | | Normal Direction | 700 | 1000 | - | 3 |
| Response Time | [msec] | Raising Time (T _r) | - | 13 | - | 4 |
| | | Falling Time (T _f) | - | 12 | - | |
| | | Raising + Falling | - | 25 | 30 | |
| Color / Chromaticity Coordinates (CIE) | | Red x | 0.593 | 0.643 | 0.693 | 5 |
| | | Red y | 0.287 | 0.337 | 0.387 | |
| | | Green x | 0.257 | 0.307 | 0.357 | |
| | | Green y | 0.550 | 0.600 | 0.650 | |
| | | Blue x | 0.100 | 0.150 | 0.200 | |
| | | Blue y | 0.014 | 0.064 | 0.114 | |
| Color Coordinates (CIE) White | | White x | 0.263 | 0.313 | 0.363 | |
| | | White y | 0.279 | 0.329 | 0.379 | |
| Central Luminance | [cd/m ²] | | 400 | 500 | - | 6 |
| Luminance Uniformity | [%] | | 70 | 75 | - | 7 |
| Color Gamut | % | | - | 72 | - | |

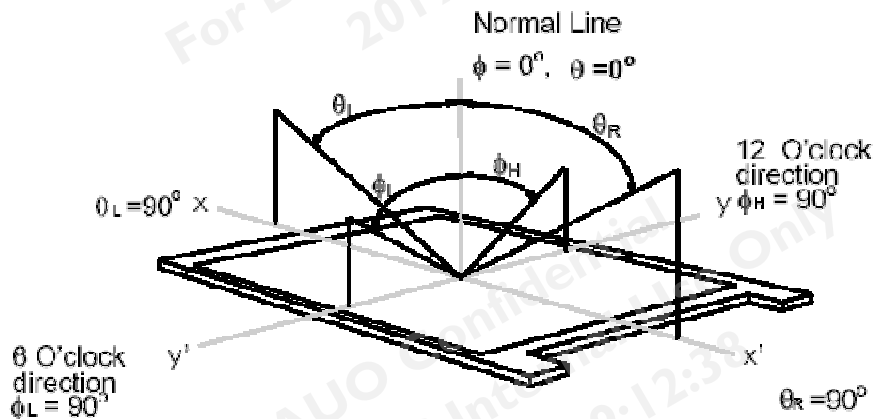
Note 1: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring (at surface 35°C). In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.



Note 2: Definition of viewing angle measured by ELDIM (EZContrast 88)

Viewing angle is the measurement of contrast ratio ≥ 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° (θ) horizontal left and right and 90° (ϕ) 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.

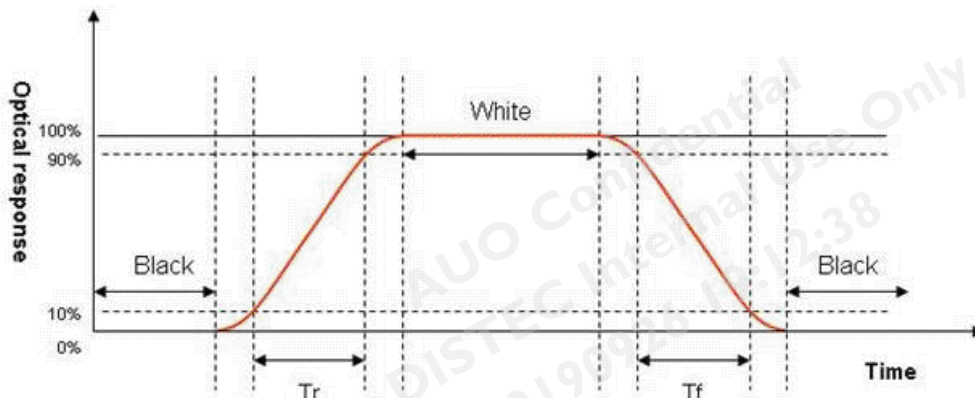


Note 3: Contrast ratio is measured by TOPCON SR-3

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

Note 4: Definition of Response time measured by Westar TRD-100A

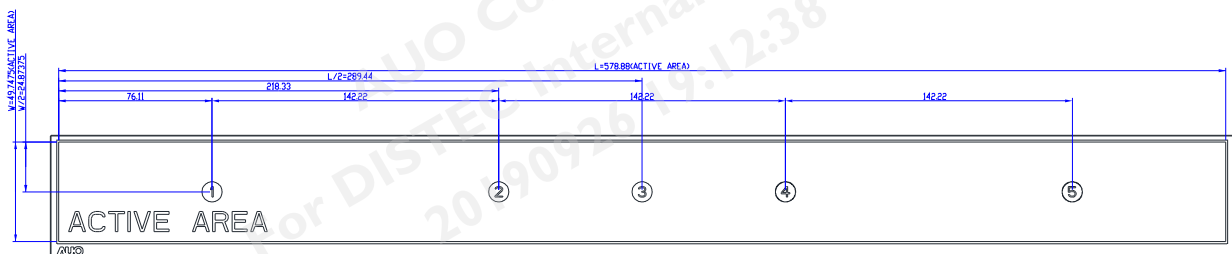
The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.



Note 5: Color chromaticity and coordinates (CIE) is measured by TOPCON SR-3

Note 6: Central luminance is measured by TOPCON SR-3

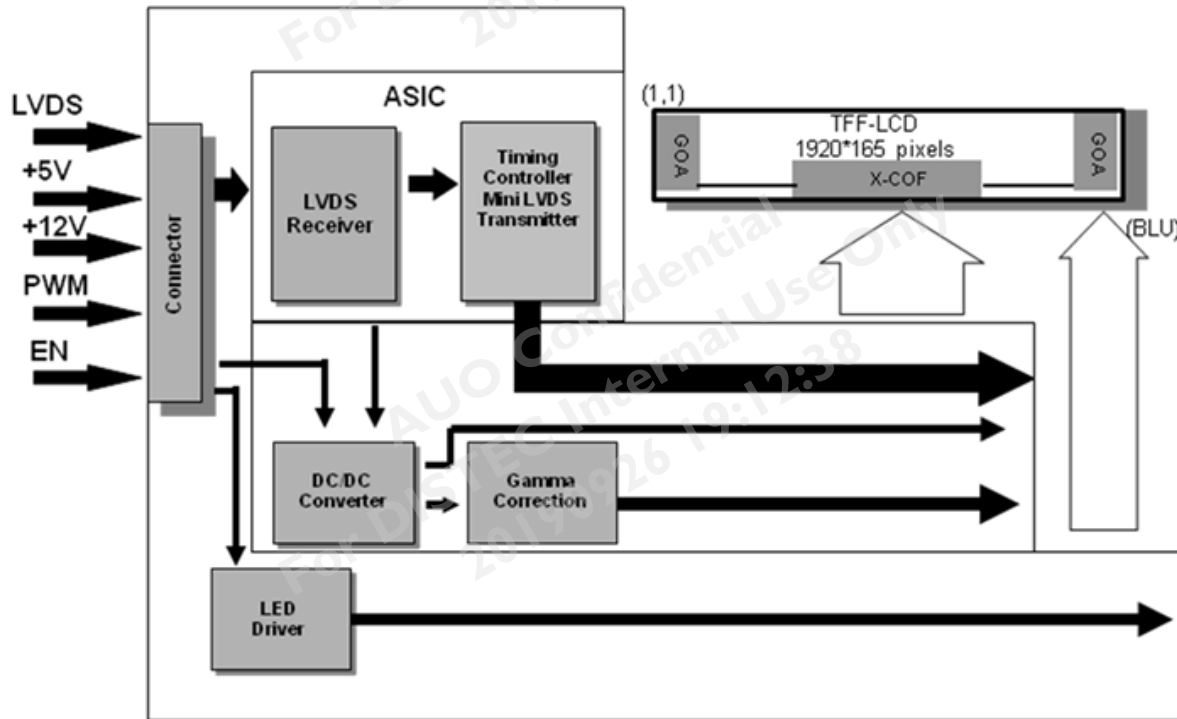
Note 7: Luminance uniformity of these 5 points is defined as below and measured by TOPCON SR-3



$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1-5)}}{\text{Maximum Luminance in 9 Points (1-5)}}$$

3.0 Functional Block Diagram

The following diagram shows the functional block of the 22.9 inch Color TFT-LCD Module:



I/F PCB Interface:

MSBKT2407P30HB

Mating Type:

FI-X30C2EL or compatible

4.0 Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD Module

| Item | Symbol | Min | Max | Unit | Conditions |
|-------------------------|--------|------|------|--------|-----------------|
| Logic/LCD Drive Voltage | VDD | -0.3 | +5.5 | [Volt] | Note 1,2 |

4.2 Absolute Ratings of Environment

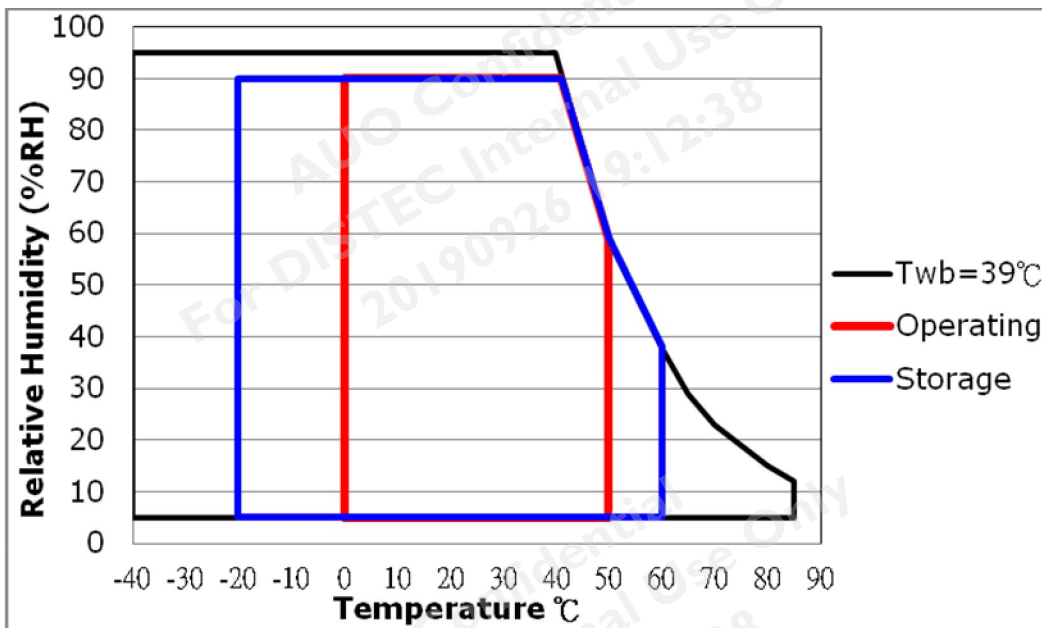
| Item | Symbol | Min. | Max. | Unit | Conditions |
|-----------------------|--------|------|------|-------|-----------------------|
| Operating Temperature | TOP | 0 | 50 | [°C] | Note 3 & 4 |
| Operation Humidity | HOP | 5 | 90 | [%RH] | |
| Storage Temperature | TST | -20 | 60 | [°C] | |
| Storage Humidity | HST | 5 | 90 | [%RH] | |

Note 1: With in Ta (25°C)

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

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

Note 4: Operation Temperature +60°C is defined as panel surface temperature.



5.0 Electrical characteristics

5.1 TFT LCD Module

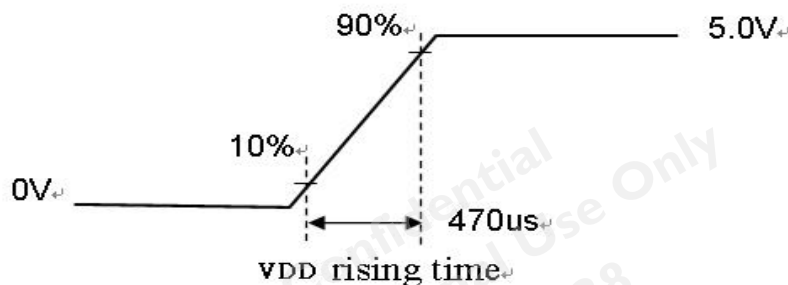
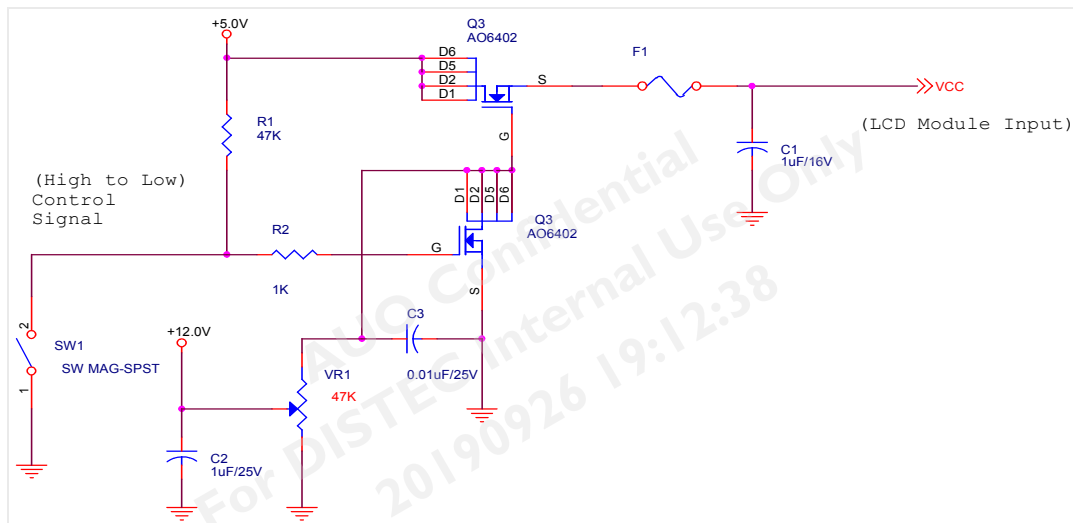
5.1.1 Power Specification

Input power specifications are as follows:

| Symbol | Parameter | Min | Typ | Max | Unit | Conditions |
|--------|--|-----|------|------|----------|---------------------------------------|
| VDD | Logic/LCD Drive Voltage | 4.5 | 5.0 | 5.5 | [Volt] | |
| IDD | Input Current | - | 0.37 | 0.44 | [A] | VDD= 5.0V, All White Pattern At 60Hz, |
| PDD | VDD Power | - | 1.85 | 2.2 | [Watt] | VDD= 5.0V, All White Pattern At 60Hz |
| IRush | Inrush Current | - | - | 3 | [A] | Note 1 |
| VDDrp | Allowable Logic/LCD Drive Ripple Voltage | - | - | 300 | [mV] p-p | VDD= 5.0V, All White Pattern At 60Hz |

Note 1: Measurement conditions:

The duration of rising time of power input is 470us.



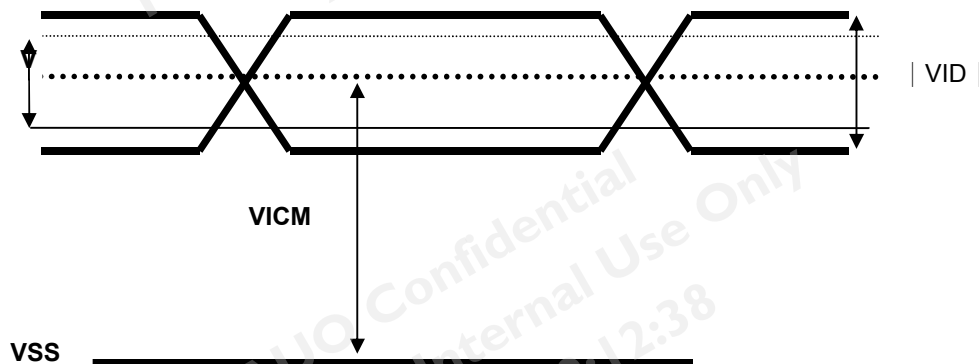
5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off. Please refer to specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Characteristics of each signal are as follows:

| Symbol | Parameter | Min | Typ | Max | Units | Condition |
|--------|--|------|------|------|-------|--|
| VTH | Differential Input High Threshold | - | - | +100 | - | VICM = 1.2V Note 1 |
| VTL | Differential Input Low Threshold | -100 | - | - | -100 | VICM = 1.2V Note 1 |
| VID | Input Differential Voltage | 100 | - | 600 | 100 | Note 1 |
| VICM | Differential Input Common Mode Voltage | +1.0 | +1.2 | +1.5 | +1.0 | VTH-VTL = 200MV (max) Note 1 |

Note 1: LVDS Signal Waveform



5.2 Backlight Unit

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

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Remark |
|-----------------------------|-----------------------|--------|--------|------|--------|--------------------------------|
| VCC | Input Voltage | 10.8 | 12 | 13.2 | [Volt] | |
| I_{VCC} | Input Current | - | 0.47 | 0.56 | [A] | 100% PWM Duty |
| P_{VCC} | Power Consumption | - | 5.7 | 6.72 | [Watt] | 100% PWM Duty |
| I_{rush LED} | Inrush Current | - | - | 3 | [A] | at rising time=470us |
| VLED on/off | On Control Voltage | 3 | 5 | 5.5 | Volt | |
| | Off Control Voltage | - | - | 0.8 | Volt | |
| F_{PWM} | Dimming Frequency | 200 | - | 20k | [Hz] | |
| | Swing Voltage | 3 | 3.3 | 5 | V | |
| | High Voltage | 3 | 3.3 | 5 | Volt | |
| | Low Voltage | - | - | 0.8 | Volt | |
| | Dimming Duty Cycle | 5 | - | 100 | % | |
| I_F | LED Forward Current | - | 18 | - | mA | Ta = 25 °C |
| V_F | LED Forward Voltage | - | 3.1 | 3.4 | Volt | I _F 18mA, Ta = 25°C |
| P_{LED} | LED Power Consumption | - | 5.4 | 5.9 | Watt | I _F 18mA, Ta = 25°C |
| LED Lifetime | | 50,000 | 70,000 | - | Hrs | I _F 18mA, Ta= 25°C |

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

Note 2: VCC, I_{VCC}, P_{VCC}, I_{rush LED} are defined for LED B/L.(100% duty of PWM dimming)

Note 3: I_F, V_F, P_{LED} are defined for single LED.

Note 4: If G229HAN01.0 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 5: Operation life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Note 6: Each LED light bar consists of 48 pcs LED package (8 strings x 6 parallel x 2 light bars)



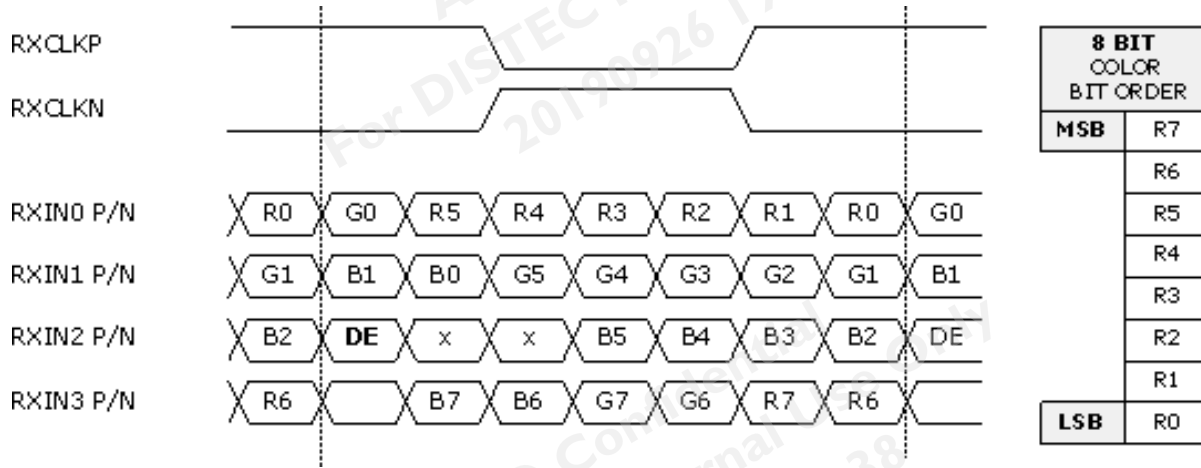
6.0 Signal Characteristic

6.1 Pixel Format Image

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

| | | | | | | | | | | | | | | | | | | |
|----------|---|---|---|---|---|---|-------|--|--|--|--|--|------|---|---|------|---|---|
| | 1 | | | 2 | | | ... | | | | | | 1919 | | | 1920 | | |
| 1st Line | R | G | B | R | G | B | | | | | | | R | G | B | R | G | B |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| | . | . | . | . | . | . | | | | | | | . | . | . | . | . | . |
| 165 Line | R | G | B | R | G | B | | | | | | | R | G | B | R | G | B |

6.2 The input data format



Note1: Normally DE mode only.

Note2: Please follow VESA.

Note3: 8-bits signal input.

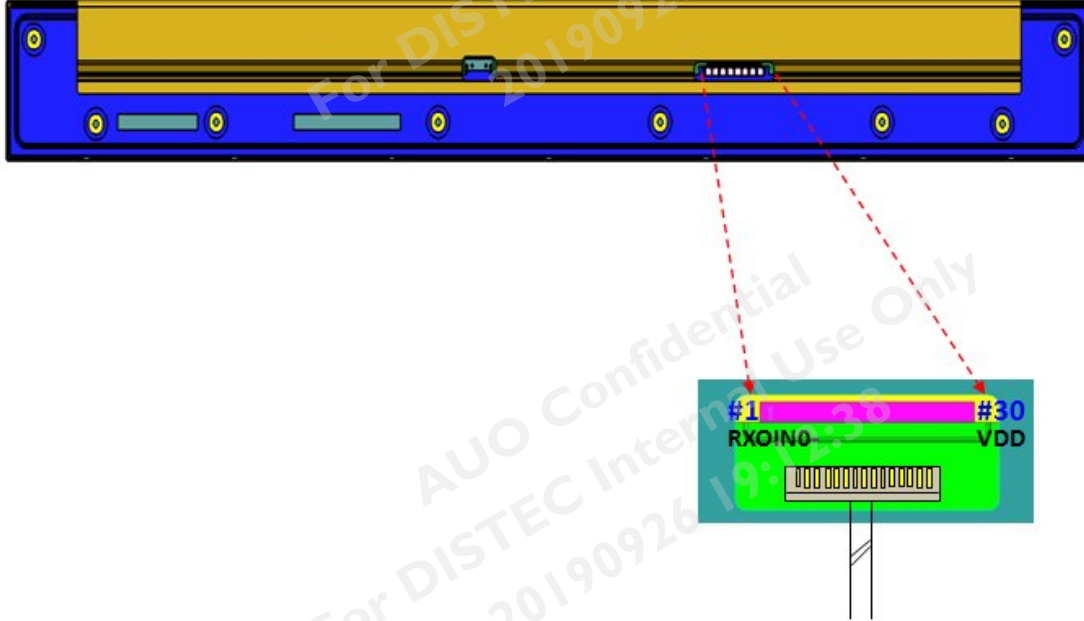
6.3 Signal Description

The module using a pair of LVDS receiver **SN75LVDS82 / SN75LVDS83**

(Texas Instruments) or compatible. 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.

| PIN # | SIGNAL NAME | I/O | DESCRIPTION |
|-------|-------------|-----|--|
| 1 | NC | -- | No contact (For AUO internal use) |
| 2 | NC | -- | No contact (For AUO internal use) |
| 3 | NC | -- | No contact (For AUO internal use) |
| 4 | GND | G | Power Ground |
| 5 | RXIN0N | I | Negative LVDS differential data input (0) |
| 6 | RXIN0P | I | Positive LVDS differential data input (0) |
| 7 | GND | G | Power Ground |
| 8 | RXIN1N | I | Negative LVDS differential data input (1) |
| 9 | RXIN1P | I | Positive LVDS differential data input (1) |
| 10 | GND | G | Power Ground |
| 11 | RXIN2N | I | Negative LVDS differential data input (2) |
| 12 | RXIN2P | I | Positive LVDS differential data input (2) |
| 13 | GND | G | Power Ground |
| 14 | RXINCLKN | I | Negative LVDS differential clock input (clock) |
| 15 | RXINCLKP | I | Positive LVDS differential data input (clock) |
| 16 | GND | G | Power Ground |
| 17 | RXIN3N | I | Negative LVDS differential data input (3) |
| 18 | RXIN3P | I | Positive LVDS differential data input (3) |
| 19 | GND | G | Power Ground |
| 20 | NC | -- | No contact (For AUO internal use) |
| 21 | NC | -- | No contact (For AUO internal use) |
| 22 | NC | -- | No contact (For AUO internal use) |
| 23 | GND | G | Power Ground |
| 24 | GND | G | Power Ground |
| 25 | GND | G | Power Ground |
| 26 | VDD | P | +5V power supply |
| 27 | VDD | P | +5V power supply |
| 28 | VDD | P | +5V power supply |
| 29 | VDD | P | +5V power supply |
| 30 | VDD | P | +5V power supply |

Note1: Start from left side



Note2: Input signals of clock shall be the same timing.

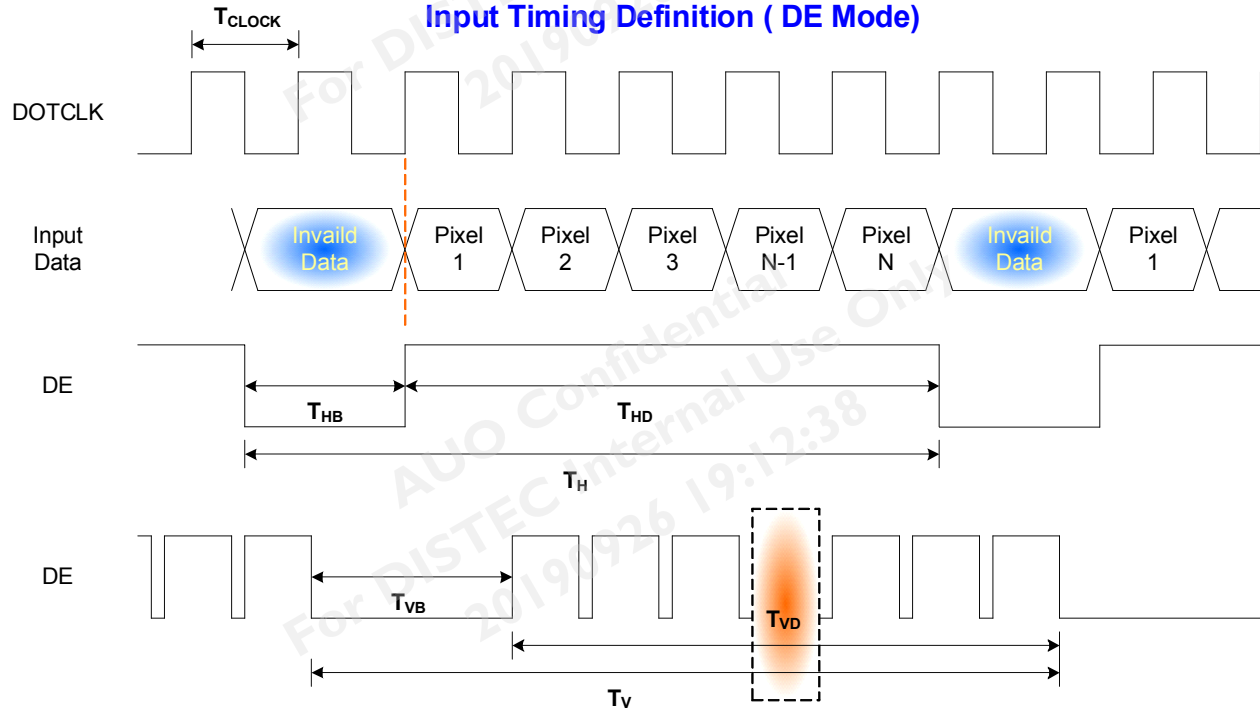
Note3: Please follow TV VESA Pin Assignment.

6.4 Timing Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | |
|--------------------|----------------------|----------|------|------|------|--------------------|
| Frame Rate | - | - | 60 | - | Hz | |
| Clock frequency | $1/T_{\text{Clock}}$ | - | 40 | - | MHz | |
| Vertical Section | Period | T_V | - | 195 | - | T_{Line} |
| | Active | T_{VD} | 165 | | | |
| | Blanking | T_{VB} | - | 30 | - | |
| Horizontal Section | Period | T_H | - | 3420 | - | T_{Clock} |
| | Active | T_{HD} | 1920 | | | |
| | Blanking | T_{HB} | - | 1500 | - | |

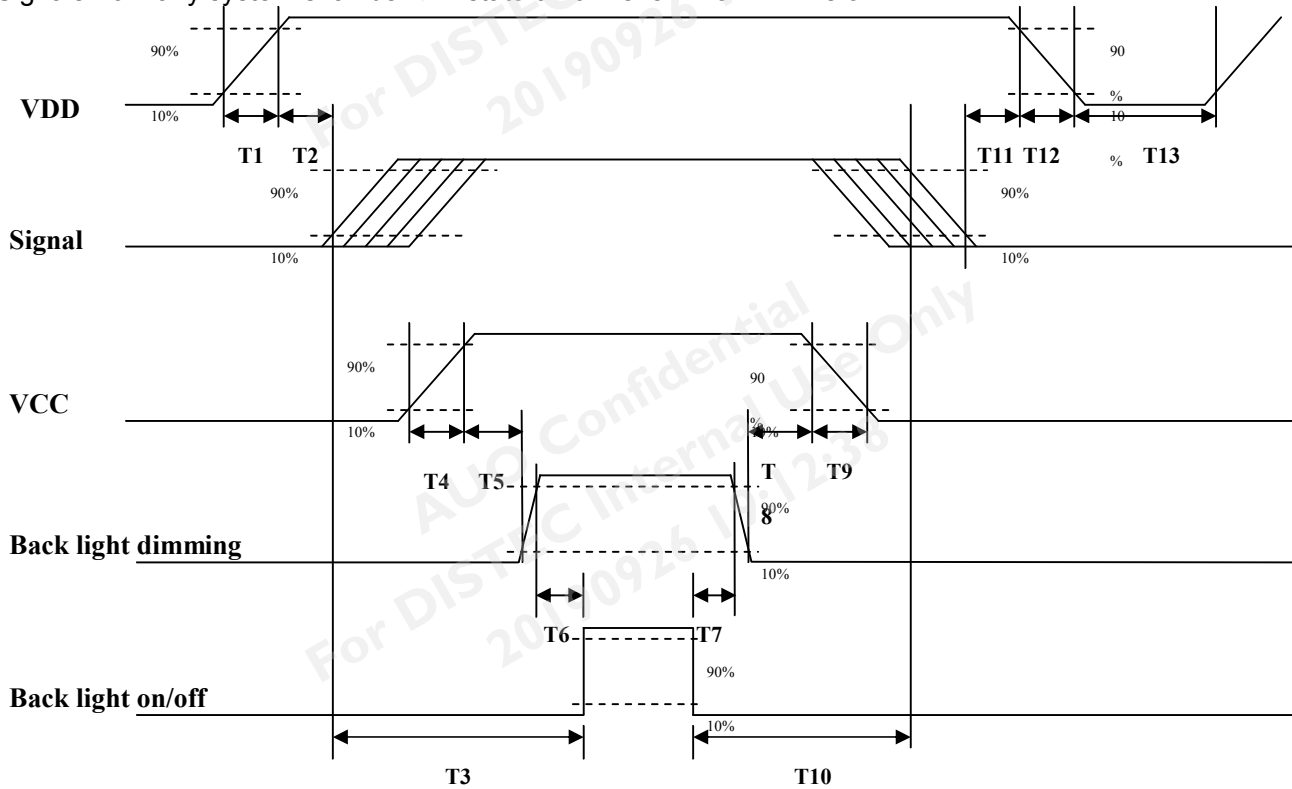
Note 1: Only DE mode operation.

6.5 Timing diagram



6.6 Power ON/OFF Sequence

VDD power and LED on/off sequence are as follows. 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 | 0.5 | 16 | 50 | [ms] |
| T12 | - | - | 100 | [ms] |

| | | | | |
|-----|------|---|---|------|
| T13 | 1000 | - | - | [ms] |
|-----|------|---|---|------|

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

| | |
|-------------------------------------|---|
| Connector Name / Designation | Interface Connector / Interface card |
| Manufacturer | SIN SHEN TERMINAL &MACHINE INC. |
| Type Part Number | MSBKT2407P30HB |
| Mating Housing Part Number | FI-X30C2EL or compatible |

7.1.1 Pin Assignment

| Pin# | Signal Name | Pin# | Signal Name |
|------|-------------|------|-------------|
| 1 | NC | 2 | NC |
| 3 | NC | 4 | GND |
| 5 | RXIN0N | 6 | RXIN0P |
| 7 | GND | 8 | RXIN1N |
| 9 | RXIN1P | 10 | GND |
| 11 | RXIN2N | 12 | RXIN2P |
| 13 | GND | 14 | RXINCLKN |
| 15 | RXINCLKP | 16 | GND |
| 17 | RXIN3N | 18 | RXIN3P |
| 19 | GND | 20 | NC |
| 21 | NC | 22 | NC |
| 23 | GND | 24 | GND |
| 25 | GND | 26 | VDD |
| 27 | VDD | 28 | VDD |
| 29 | VDD | 30 | VDD |

7.2 LED Backlight Unit: LED Driver Connector

| Connector Name / Designation | LED Connector |
|-------------------------------|--------------------------------|
| Manufacturer | ENTERY INDUSTRIAY CO. |
| Connector Model Number | 3808K-F08N-12R |
| Mating Connector Model Number | MOLEX 51146-0800 or compatible |

7.3 LED Driver Connector Pin Assignment

| Pin# | Symbol | Signal Name |
|------|---------|----------------|
| 1 | GND | GND |
| 2 | GND | GND |
| 3 | GND | GND |
| 4 | Enable | 5V-On / 0V-Off |
| 5 | Dimming | PWM Dimming |
| 6 | VCC | 12V |
| 7 | VCC | 12V |
| 8 | VCC | 12V |

8.0 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= 50°C, 300hours | 3 |
| Low Temperature Operation (LTO) | Ta= 0°C, 300hours | |
| High Temperature Storage (HTS) | Ta= 60°C, 300hours | |
| Low Temperature Storage (LTS) | Ta= -20°C, 300hours | |
| Vibration Test (Non-operation) | Acceleration: 1.5 G Wave: Sine Frequency: 10 - 200 - 10 Hz Sweep: 30 Minutes each Axis (X, Y, Z) | |
| Shock Test (Non-operation) | Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis) | |
| 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 (Electro Static Discharge) | Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point. | 2 |
| | Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point. | |
| Altitude Test | Operation:10,000 ft Non-Operation:30,000 ft | |

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.

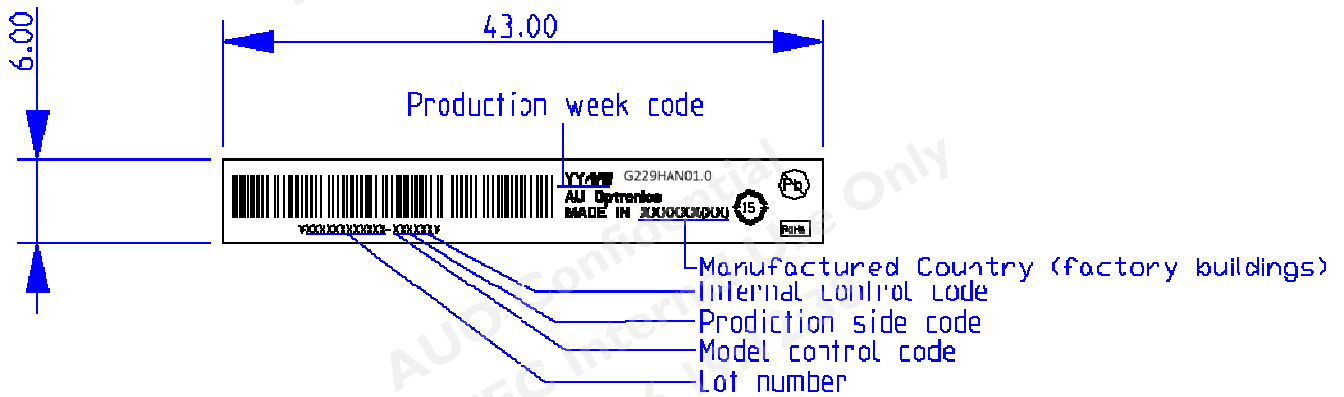
Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3: No function occurs Mura shall be ignored after high temperature reliability test.

9.0 Shipping Label & Packaging


9.1 Shipping Label


The label is on the panel as shown below:



Unit: mm

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 Packaging



Max capacity : 14 TFT-LCD module per carton

Max weight: 13kg per carton

Outside dimension of carton: 730mm(L) * 310mm(W) * 285mm(H)

Pallet size : 980mm * 740 mm * 132mm

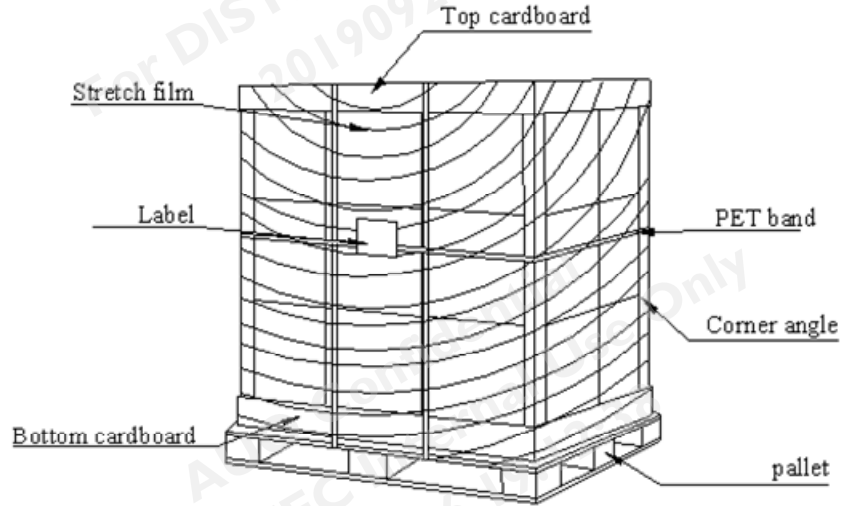
Box stacked

Module by air : (1 *3) *5 layers , one pallet put 15boxes , total 210pcs module

Module by sea : (1 *3) *5 layers + (1 *3) *1 layers , two pallet put 18boxes, total 252pcs module

Module by sea_ HQ : (1 *3) *5 layers + (1 *3) *2 layers, two pallet put 21boxes, total 294pcs module

9.3 Shipping Package of Palletizing Sequence



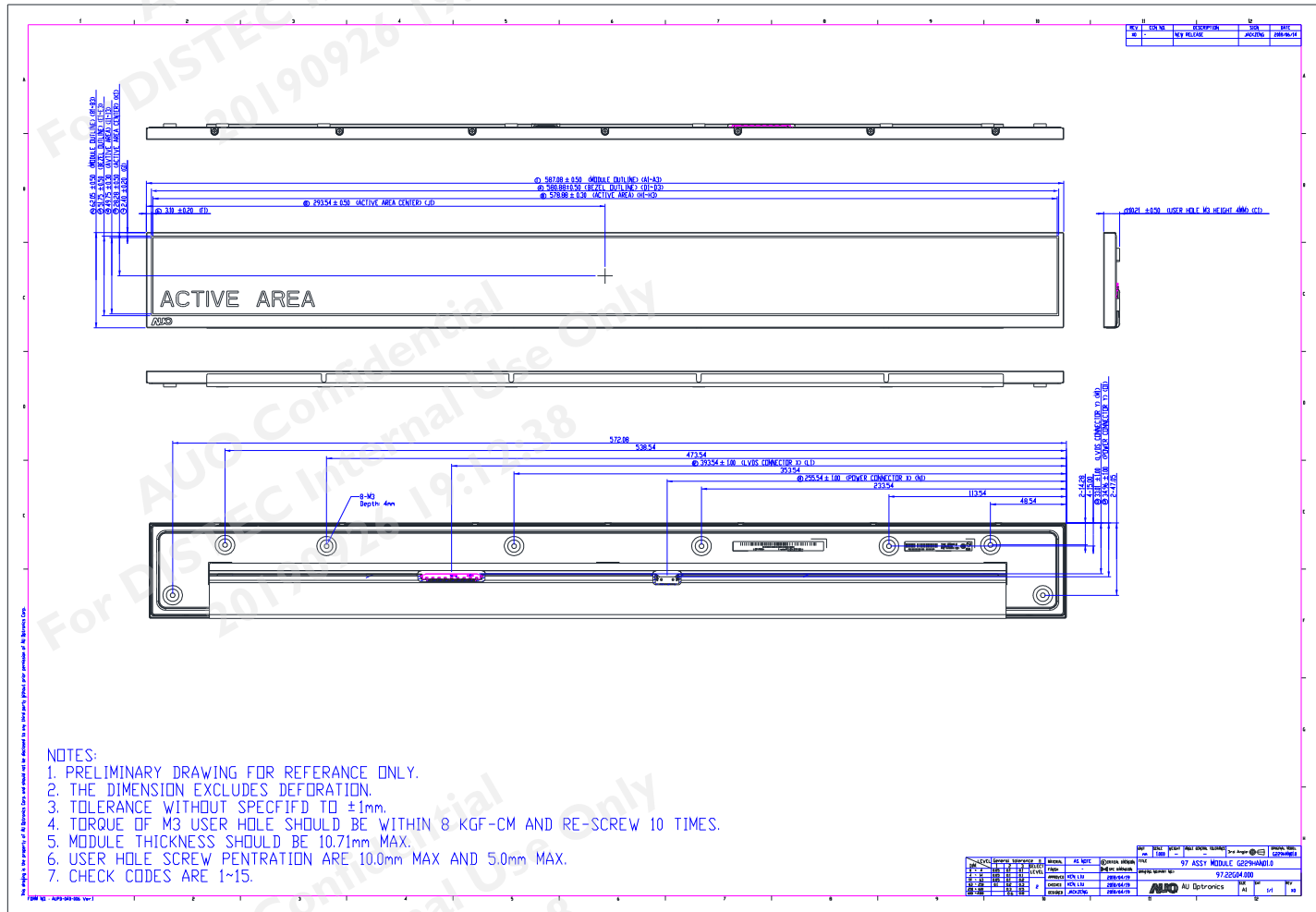


Product Specification

G229HAN01.0

AU OPTRONICS CORPORATION

10.0 Mechanical Characteristics



11 Safety

11.1 Sharp Edge Requirements

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

11.2 Materials

11.2.1 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.

11.2.2 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.

11.3 Capacitors

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

11.4 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

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