



Product Specification

AU Optronics Corporation

G170ETN02.1

- () Preliminary Specification
(V) Final Specification

| | |
|------------|---------------------------------|
| Module | 17.0" SXGA Color TFT-LCD Module |
| Model Name | G170ETN02.1 |

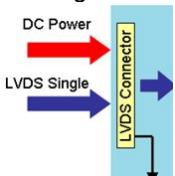
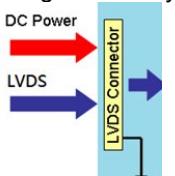
| | | | |
|---|-------|-----------------------|-------------------|
| Customer | Date | Checked & Approved by | Date |
| _____ | _____ | <u>Crystal Hsieh</u> | <u>2017/11/07</u> |
| Checked & Approved by | Date | Prepared by | Date |
| _____ | _____ | <u>BinJou Huang</u> | <u>2017/11/07</u> |
| General Display Business Division / AU Optronics corporation | | | |



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Record of Revision

| Version and Date | Page | Old description | New Description |
|-------------------------|-------------|--|--|
| 1.0 2017/09/09 | All | First Edition for Customer | |
| 1.1 2017/10/03 | 9 | Functional Block Diagram Modify  | Functional Block Diagram Modify  |
| 1.2 2017/11/07 | 18 | 6.5 Power ON/OFF Sequence (w/ LED driver board) | Modify: 6.5 Power ON/OFF Sequence (w/o LED driver board) |
| | | | |



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 (IEC60950-1 or UL60950-1), or be applied exemption.
- 13) Continuous operating TFT-LCD display under high temperature environment may accelerate LED exhaustion and reduce luminance dramatically.
- 14) 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.



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2. General Description

This specification applies to the 17 inch Color TFT-LCD Module G170ETN02.1.

The display supports the SXGA (1280(H) x 1024(V)) screen format and 16.7M colors. All input signals are Dual Channel 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] | 432 (17.0") |
| Active Area | [mm] | 337.920(H) x 270.336(V) |
| Pixels H x V | | 1280 x 3(RGB) x 1024 |
| Pixel Pitch | [mm] | 0.264(per one triad) x 0.264 |
| Pixel Arrangement | | R.G.B. Vertical Stripe |
| Display Mode | | Normally White |
| White Luminance | [cd/m ²] | 800 (Typ) |
| Contrast Ratio | | 700 : 1 (Typ) |
| Optical Response Time | [msec] | 20 |
| Nominal Input Voltage VDD | [Volt] | +5.0 (Typ) |
| Power Consumption | [Watt] | Logic 4.5W (max) @ All Black pattern (max.) BL 13.6W (max.) (w/o LED driver board) |
| Weight | [Grams] | 1590 (Max.) |
| Physical Size (H x V x D) | [mm] | 358.5(H) x 296.5(V) Typ. x 12.45(D) typ |
| Electrical Interface | | Dual Channel LVDS |
| Surface Treatment | | Anti-glare type, Hardness 3H |
| Support Color | | 16.7M colors (8-bits) |
| Temperature Range | | |
| Operating | [°C] | -30 to +85 |
| Storage (Non-Operating) | [°C] | -30 to +85 |
| RoHS Compliance | | RoHS Compliance |



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2.2 Optical Characteristics

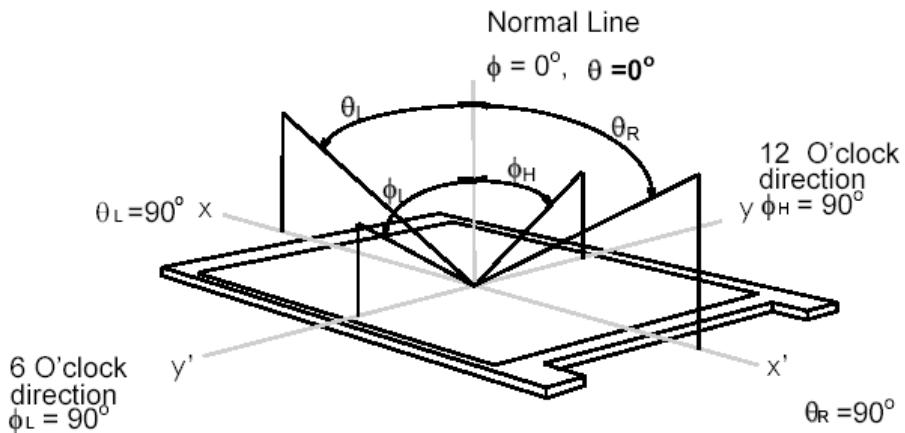
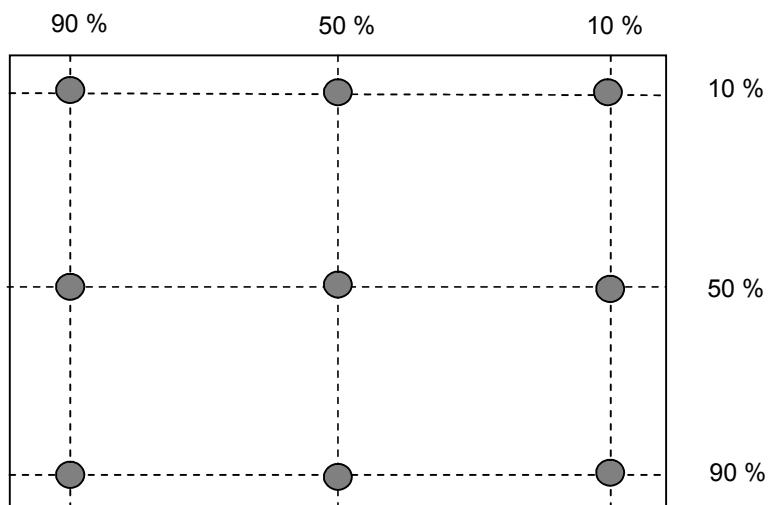
The optical characteristics are measured under stable conditions at 25°C (Room Temperature):

| Item | Unit | Conditions | Min. | Typ. | Max. | Note |
|---|----------------------|--------------------------------------|----------|----------|-------|------|
| Viewing Angle | [degree] | Horizontal (Right) CR = 10 (Left) | 70 70 | 80 80 | - | 1 |
| | | Vertical (Up) CR = 10 (Down) | 50 60 | 70 70 | - | |
| Luminance Uniformity | [%] | 9 Points | 75 | 80 | - | 2, 3 |
| Contrast Ratio | | | 500 | 700 | - | 4 |
| White Luminance | [cd/m ²] | | 640 | 800 | - | 4 |
| Optical Response Time | [msec] | Rising | - | 15 | - | 5 |
| | | Falling | - | 5 | - | |
| | | Rising + Falling | - | 20 | - | |
| Color / Chromaticity Coordinates (CIE 1931) | | Red x | 0.590 | 0.640 | 0.690 | |
| | | Red y | 0.293 | 0.343 | 0.393 | |
| | | Green x | 0.274 | 0.324 | 0.374 | |
| | | Green y | 0.577 | 0.627 | 0.677 | |
| | | Blue x | 0.106 | 0.156 | 0.206 | |
| | | Blue y | 0.016 | 0.066 | 0.116 | |
| | | White x | 0.263 | 0.313 | 0.363 | |
| NTSC | [%] | White y | 0.279 | 0.329 | 0.379 | |
| | | | | 72 | | |

Optical Equipment: BM-5A, BM-7, PR880, or equivalent

Note 1: Definition of viewing angle

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.

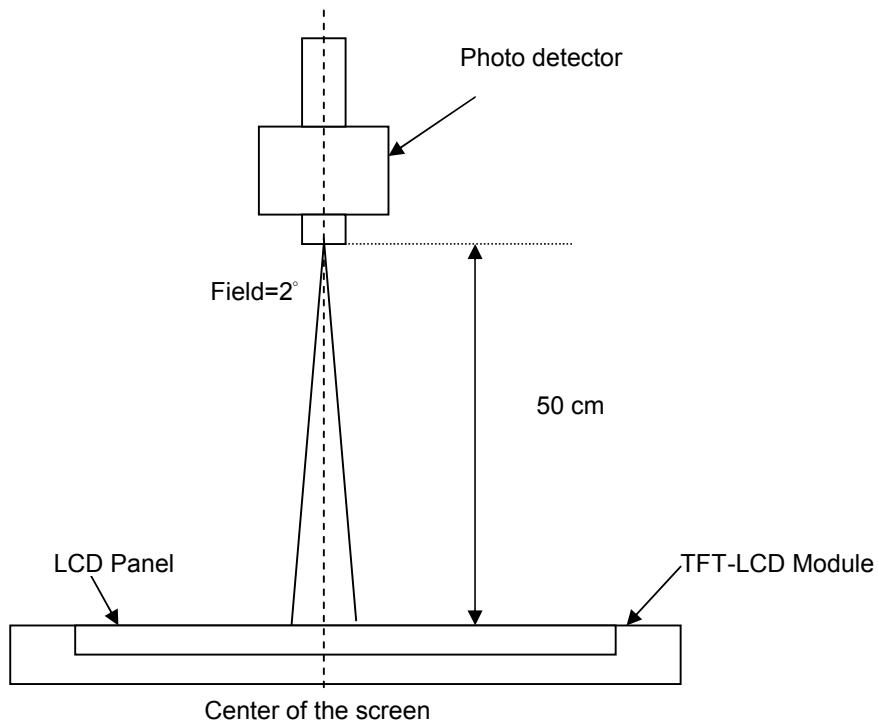

Note 2: 9 points position


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

$$\delta_{W9} = \frac{\text{Minimum Luminance of 9 points}}{\text{Maximum Luminance of 9 points}}$$

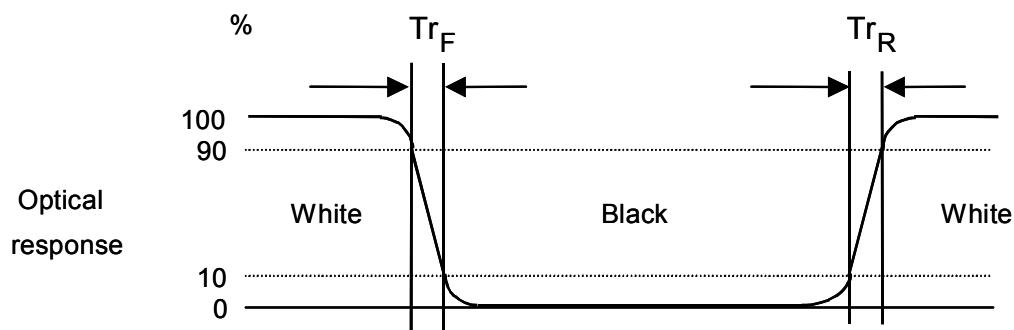
Note 4: Measurement method

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.



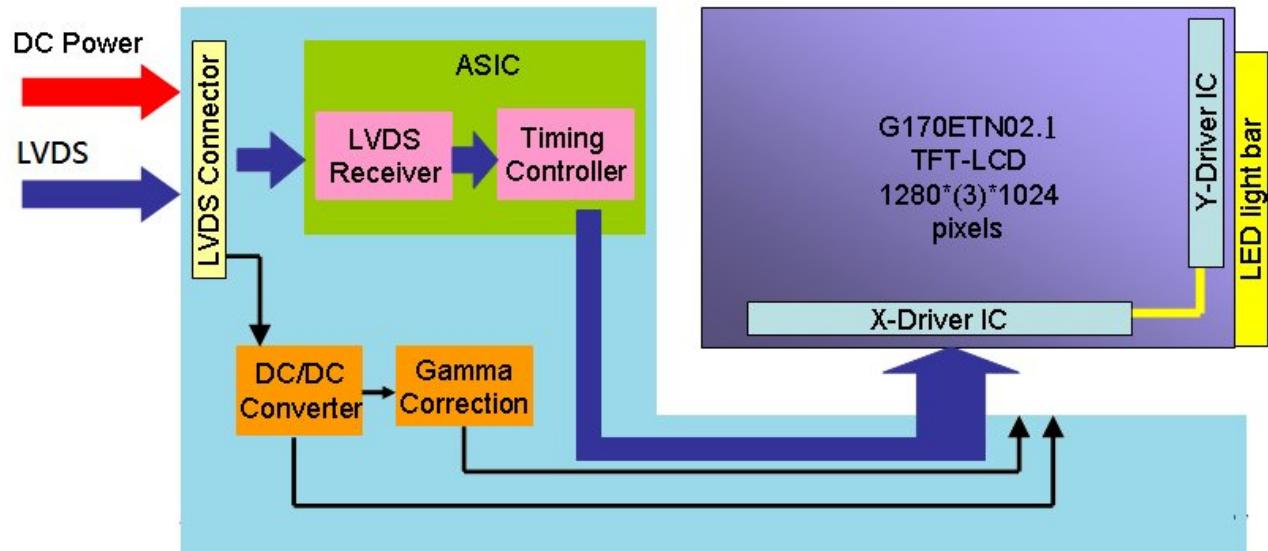
Note 5: Definition of response time:

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



3. Functional Block Diagram

The following diagram shows the functional block of the 17.0 inches Color TFT-LCD Module:



4. Absolute Maximum Ratings

An absolute maximum ratings of the module is as following:

4.1 TFT LCD Module

| Item | Symbol | Min | Max | Unit | Conditions |
|-------------------------|-------------------------|------|-----|--------|----------------------------|
| Logic/LCD Drive Voltage | VDD | -0.3 | +6 | [Volt] | Note 1,2 |
| Signal Voltage | RxOINi-/+, RxEINI-/+ | -0.3 | 4 | [Volt] | Note 1,2, i=0,1,2,3 |
| Signal Voltage | RxOCLKON-/+ RxECLKIN-/+ | -0.3 | 4 | [Volt] | Note 1,2 |

4.2 Backlight Unit

| Item | Symbol | Min | Typ | Unit | Conditions |
|---------------------|----------------|-----|-----|------|-----------------|
| LED Forward Current | I _F | - | 100 | [mA] | Note 1,2 |

4.3 Absolute Ratings of Environment

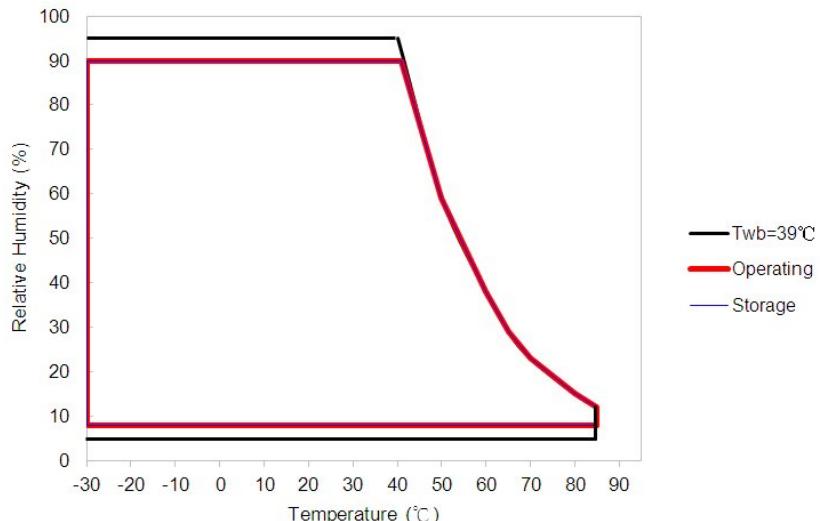
| Item | Symbol | Min | Max | Unit | Conditions |
|-----------------------|--------|-----|-----|-------|---------------|
| Operating Temperature | TOP | -30 | +85 | [°C] | Note 3 |
| Operation Humidity | HOP | 8 | 90 | [%RH] | |
| Storage Temperature | TST | -30 | +85 | [°C] | |
| Storage Humidity | HST | 8 | 90 | [%RH] | |

Note 1: Within Ta (25°C)

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

Note 3: Temperature and relative humidity range are shown as the below

1. 90% RH Max
2. Max wet-bulb temperature at 39°C or less. (Ta ≤ 39°C)
3. No condensation



5. Electrical Characteristics

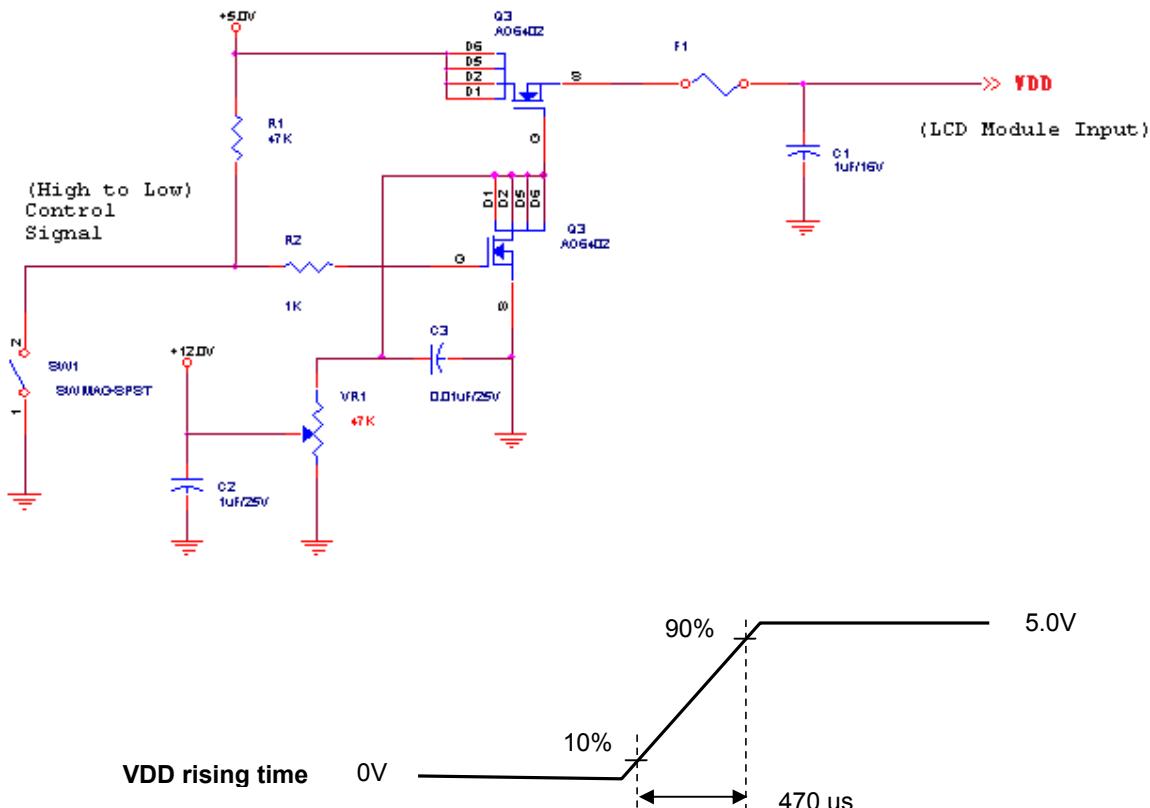
5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows:

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Condition |
|--------|--|------|------|------|-------------|-------------------------------------|
| VDD | Logic/LCD Drive Voltage | 4.5 | 5.0 | 5.5 | [Volt] | $\pm 10\%$ |
| IDD | Input Current | - | 0.8 | 1.0 | [A] | VDD=5V , All Black Pattern, at 60Hz |
| IRush | Inrush Current | - | - | 2.5 | [A] | Note |
| PDD | VDD Power | - | 4 | 4.5 | [Watt] | VDD=5V , All Black Pattern, at 60Hz |
| VDDRp | Allowable Logic/LCD Drive Ripple Voltage | - | - | 200 | [mV] p-p | VDD=5V , All Black Pattern, at 60Hz |

Note: Measurement conditions:



5.1.2 Signal Electrical Characteristics

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

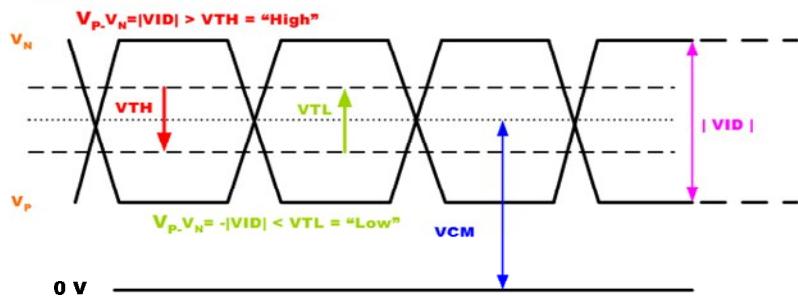
It is recommended to refer the specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Each signal characteristics are as follows;

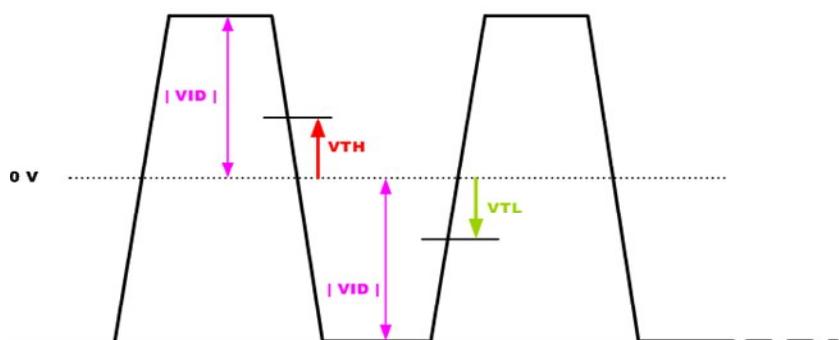
| Symbol | Parameter | Min | Typ | Max | Units | Condition |
|------------|--|------|------|------|-------|--|
| V_{TH} | Differential Input High Threshold | - | - | +100 | [mV] | $V_{CM} = 1.2V$ Note |
| V_{TL} | Differential Input Low Threshold | -100 | - | - | [mV] | $V_{CM} = 1.2V$ Note |
| $ V_{ID} $ | Input Differential Voltage | 100 | 400 | 600 | [mV] | Note |
| V_{CM} | Differential Input Common Mode Voltage | +1.0 | +1.2 | +1.5 | [V] | $V_{TH}-V_{TL} = 200mV$ (max) Note |

Note: LVDS Signal Waveform

Single-end Signal



Differential Signal





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5.1.3 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25°C (Room Temperature)

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Note |
|------------|--|--------|------|------|------------------|---|
| IR_{LED} | LED Operation Current | - | 100 | - | [mA] Note 1 | Operating with fixed driving current |
| V_{LB} | Light Bar Operation Voltage (for reference) | - | 31 | 34 | [Volt] Note 2 | |
| P_{BLU} | BLU Power consumption (for reference) | - | 12.4 | 13.6 | [Watt] | |
| LT_{LED} | LED life Time (Typical) | 50,000 | - | - | [Hour] Note 3 | |

Note 1 :The specified current is input LED chip 100% duty current.

Note 2 : The value showed in the table is one light bar's operation voltage.

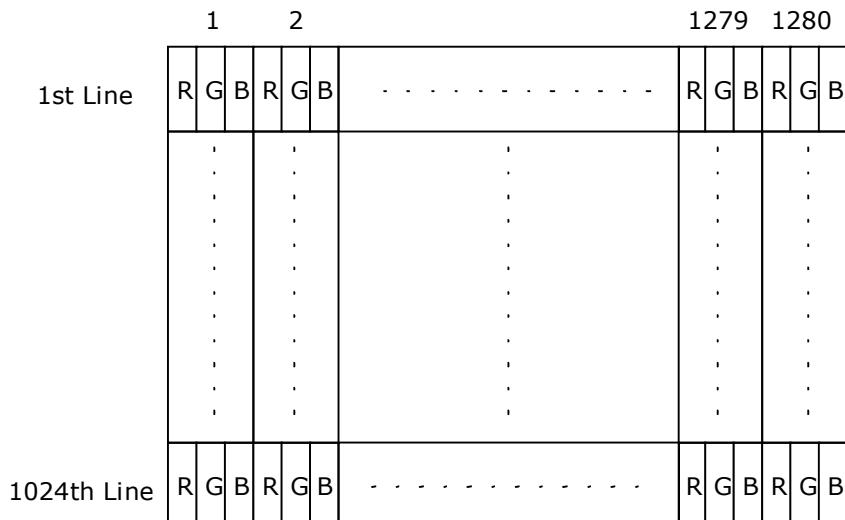
Note 3 : Definition of life time : brightness becomes 50% of its original value.

Note 4 : Each LED light bar consists of 40 pcs LED package (4 strings x 10 pcs / string).

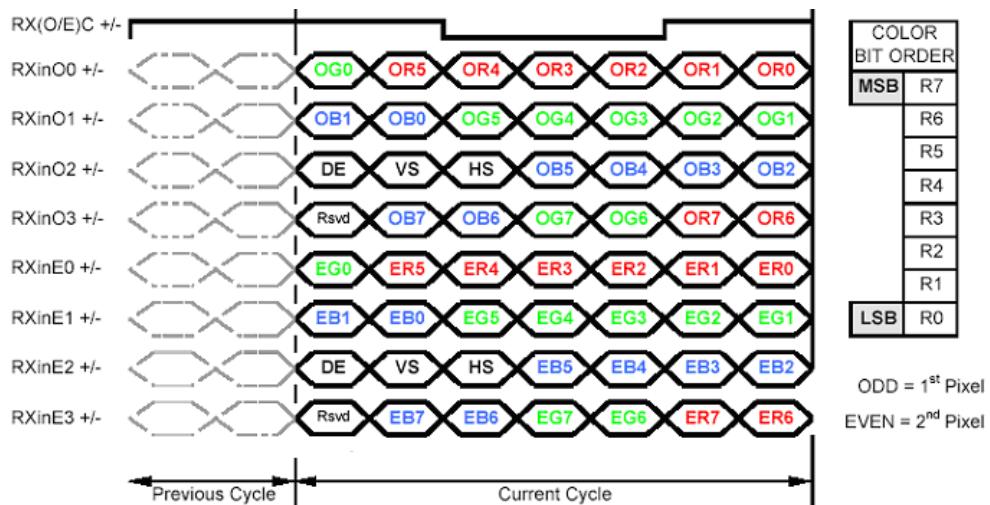
6. Signal Characteristic

6.1 Pixel Format Image

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



6.2 The Input Data Format



Note1: Normally, DE, VS, HS on EVEN channel are not used.

Note2: Please follow PSWG.

Note3: 8-bit in

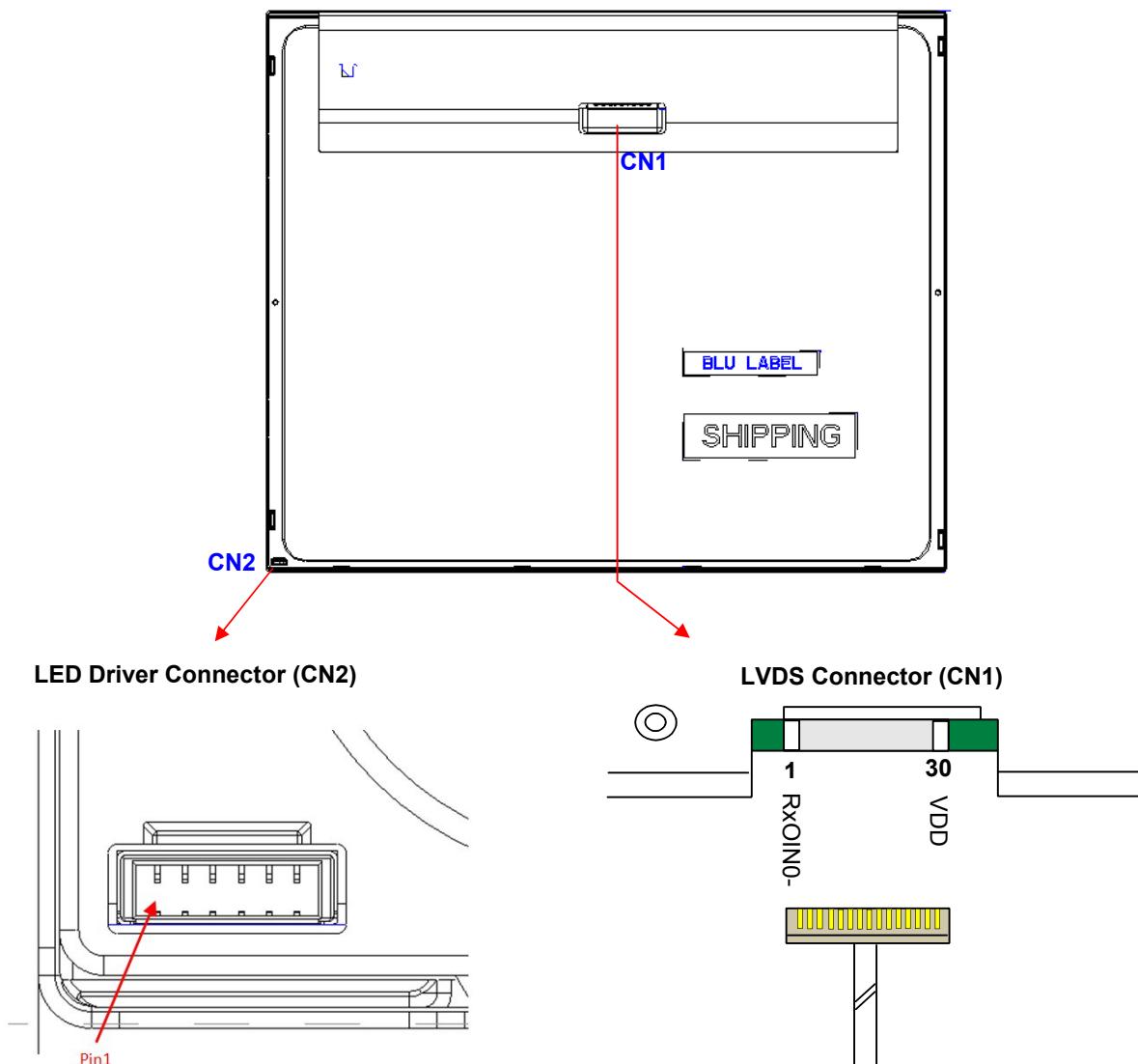


6.3 Signal Description

The module is using a pair of LVDS receiver SN75LVDS82DGG (Texas Instruments) or compatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. LVDS transmitter shall be SN75LVDS82DGG (negative edge sampling) or compatible. The first LVDS port (RxOxxx) transmits odd pixels while the second LVDS port (RxExxx) transmits even pixels.

LVDS Connector Pin Assignment (CN1)

| PIN # | SIGNAL NAME | DESCRIPTION |
|-------|--------------|--|
| 1 | RxOIN0- | Negative LVDS differential data input (Odd data) |
| 2 | RxOIN0+ | Positive LVDS differential data input (Odd data) |
| 3 | RxOIN1- | Negative LVDS differential data input (Odd data) |
| 4 | RxOIN1+ | Positive LVDS differential data input (Odd data) |
| 5 | RxOIN2- | Negative LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG) |
| 6 | RxOIN2+ | Positive LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG) |
| 7 | GND | Power Ground |
| 8 | RxOCLKIN- | Negative LVDS differential clock input (Odd clock) |
| 9 | RxOCLKIN+ | Positive LVDS differential clock input (Odd clock) |
| 10 | RxOIN3- | Negative LVDS differential data input (Odd data) |
| 11 | RxOIN3+ | Positive LVDS differential data input (Odd data) |
| 12 | RxEIN0- | Negative LVDS differential data input (Even data) |
| 13 | RxEIN0+ | Positive LVDS differential data input (Even data) |
| 14 | GND | Power Ground |
| 15 | RxEIN1- | Negative LVDS differential data input (Even data) |
| 16 | RxEIN1+ | Positive LVDS differential data input (Even data) |
| 17 | GND | Power Ground |
| 18 | RxEIN2- | Negative LVDS differential data input (Even data) |
| 19 | RxEIN2+ | Positive LVDS differential data input (Even data) |
| 20 | RxECLKIN- | Negative LVDS differential clock input (Even clock) |
| 21 | RxECLKIN+ | Positive LVDS differential clock input (Even clock) |
| 22 | RxEIN3- | Negative LVDS differential data input (Even data) |
| 23 | RxEIN3+ | Positive LVDS differential data input (Even data) |
| 24 | GND | Power Ground |
| 25 | GND (AGMODE) | Power Ground (For AUO test Aging mode) |
| 26 | GND | Power Ground |
| 27 | GND | Power Ground |
| 28 | VDD | +5.0V Power Supply |
| 29 | VDD | +5.0V Power Supply |
| 30 | VDD | +5.0V Power Supply |



6.4 Timing Characteristics

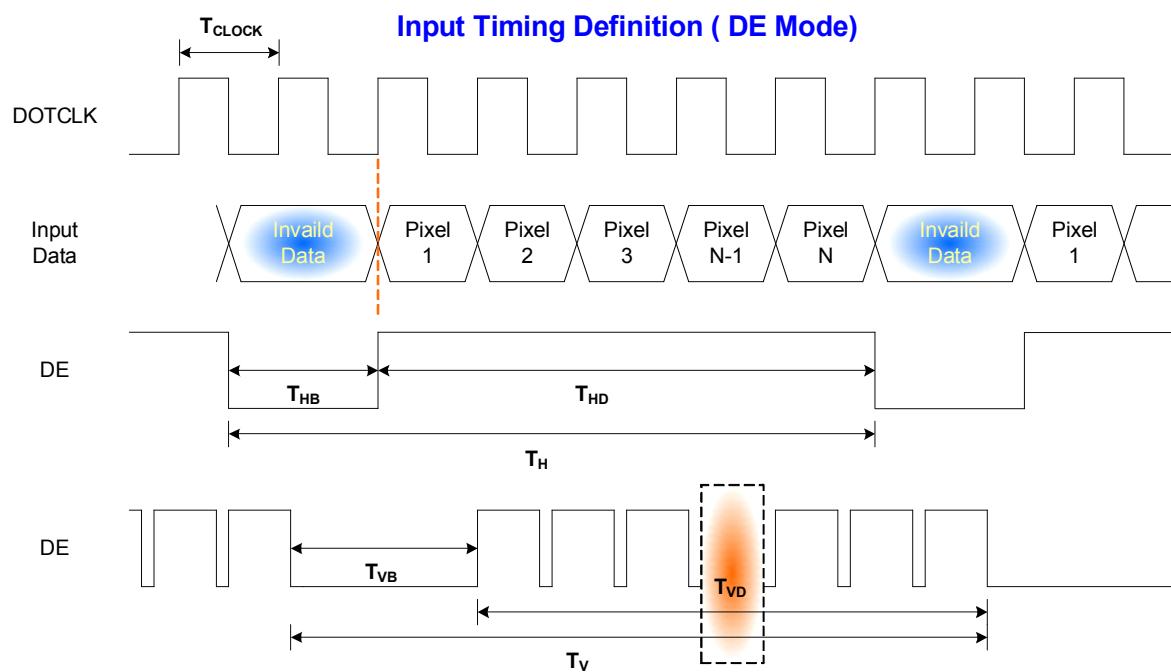
6.4.1 Timing Characteristics

Basically, interface timings described here is not actual input timing of LCD module but output timing of SN75LVDS82DGG (Texas Instruments) or equivalent.

| Signal | Item | Symbol | Min | Typ | Max | Unit |
|--------------------|------------|-------------------------------|------|-------|------|------|
| Vertical Section | Period | T_v | 1034 | 1066 | 1150 | Th |
| | Active | $T_{disp(v)}$ | 1024 | 1024 | 1024 | Th |
| | Blanking | $T_{bp(v)}+T_{fp(v)}+PW_{vs}$ | 10 | 42 | 126 | Th |
| Horizontal Section | Period | T_h | 750 | 844 | 2048 | Tclk |
| | Active | $T_{disp(h)}$ | 640 | 640 | 640 | Tclk |
| | Blanking | $T_{bp(h)}+T_{fp(h)}+PW_{hs}$ | 110 | 204 | 400 | Tclk |
| Clock | Period | T_{clk} | 25 | 18.52 | 11 | ns |
| | Frequency | Freq | 40 | 54 | 91 | MHz |
| Frame rate | Frame rate | F | 51 | 60 | 76 | Hz |

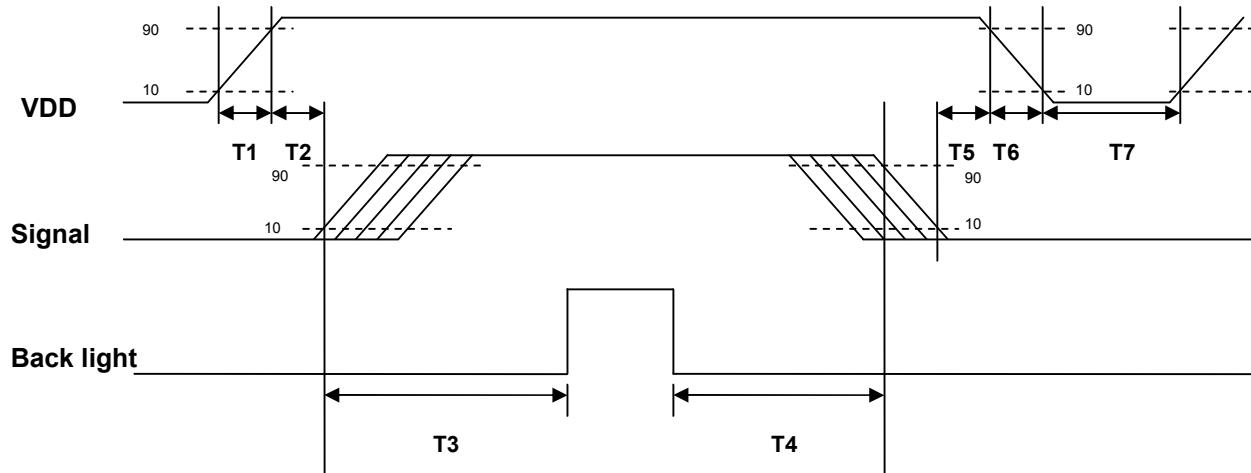
Note : DE mode only

6.4.2 Timing Diagram



6.5 Power ON/OFF Sequence

VDD power and LED on/off sequence is 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 Sequence Timing

| Parameter | Value | | | Unit |
|-----------|-------|------|------|------|
| | Min. | Typ. | Max. | |
| T1 | 0.5 | - | 10 | [ms] |
| T2 | 30 | 40 | 50 | [ms] |
| T3 | 200 | - | - | [ms] |
| T4 | 110 | - | - | [ms] |
| T5 | 0 | 16 | 50 | [ms] |
| T6 | - | - | 10 | [ms] |
| T7 | 1000 | - | - | [ms] |



7. 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

7.1.1 Connector

| Connector Name / Designation | Interface Connector |
|------------------------------|---------------------|
| Manufacturer | HRS |
| Type Part Number | MDF76URW-30S-1H(55) |
| Mating Housing Part Number | MDF76-30P-1C |

7.1.2 LVDS Pin Assignment (CN1)

| Pin# | Signal Name | Pin# | Signal Name |
|------|--------------|------|-------------|
| 1 | RxOIN0- | 2 | RxOIN0+ |
| 3 | RxOIN1- | 4 | RxOIN1+ |
| 5 | RxOIN2- | 6 | RxOIN2+ |
| 7 | GND | 8 | RxOCLKIN- |
| 9 | RxOCLKIN+ | 10 | RxOIN3- |
| 11 | RxOIN3+ | 12 | RxEIN0- |
| 13 | RxEIN0+ | 14 | GND |
| 15 | RxEIN1- | 16 | RxEIN1+ |
| 17 | GND | 18 | RxEIN2- |
| 19 | RxEIN2+ | 20 | RxECLKIN- |
| 21 | RxECLKIN+ | 22 | RxEIN3- |
| 23 | RxEIN3+ | 24 | GND |
| 25 | GND (AGMODE) | 26 | GND |
| 27 | GND | 28 | VDD |
| 29 | VDD | 30 | VDD |

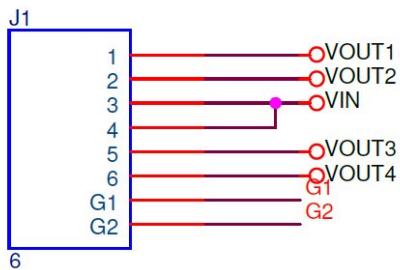
7.2 Backlight Unit

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 Connector |
|------------------------------|----------------|
| Manufacturer | E&T |
| Connector Model Number | 3707K-S06N-00L |

7.2.1 Pin Assignment (CN2)

| Pin No. | Signal Name |
|---------|-------------|
| 1 | VOUT1 |
| 2 | VOUT2 |
| 3 | VIN |
| 4 | VIN |
| 5 | VOUT3 |
| 6 | VOUT4 |





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8. Reliability Test

Environment test conditions are listed as following table.

| Items | Required Condition | Note |
|-----------------------------------|---|------|
| Temperature Humidity Bias (THB) | Ta= 50°C, 80%RH, 240hours | 2 |
| High Temperature Operation (HTO) | Ta= 85°C, 240hours | 2 |
| Low Temperature Operation (LTO) | Ta= -30°C, 240hours | 2 |
| High Temperature Storage (HTS) | Ta= 85°C, 240hours | 2 |
| Low Temperature Storage (LTS) | Ta= -30°C, 240hours | 2 |
| Vibration Test (Non-operation) | Acceleration: 1.5 Grms Wave: Random Frequency: 10 – 200 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) | |
| Thermal Shock Test (TST) | -20°C/30min, 60°C/30min, 50 cycles | |
| On/Off Test | On/10sec, Off/10sec, 30,000 cycles | |
| ESD | Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point. | 1 |
| | Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point. | |

Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost Self-recoverable.

No hardware failures.

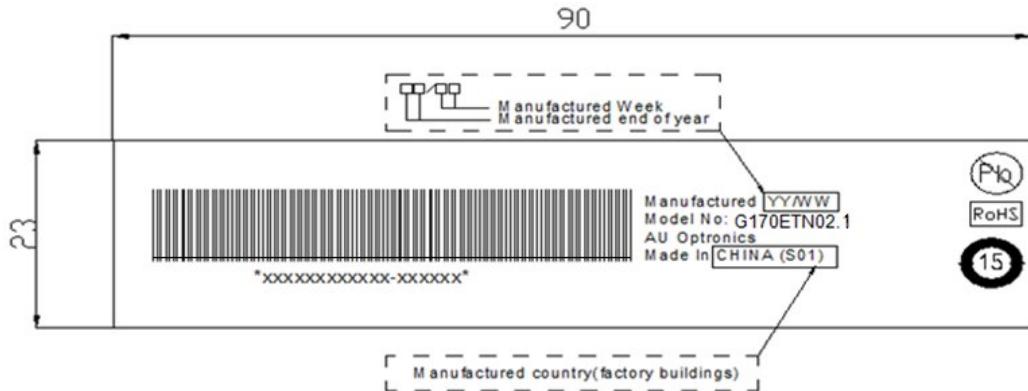
Note2:

- 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.

9. Label and Packaging

9.1 Shipping Label

The shipping label format is shown as below.



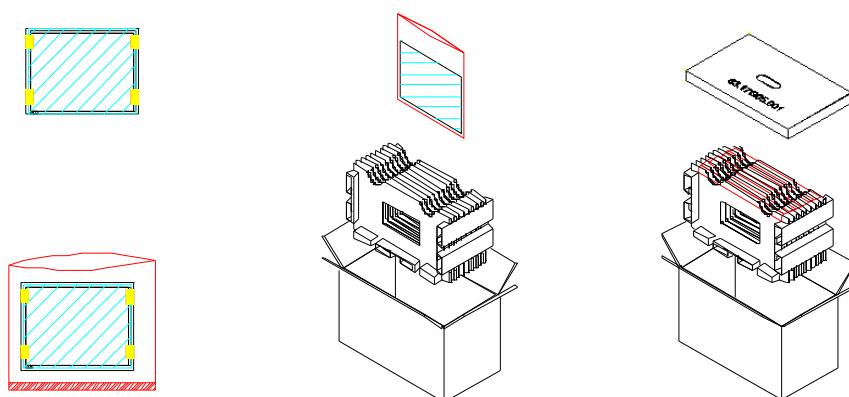
9.2 Carton Package

Max capacity : 8 TFT-LCD module per carton

Max weight: 13.5 kg per carton

Outside dimension of carton:448(L)mm*283(W)mm*397(H)mm

Pallet size : 1150 mm *910 mm * 138mm

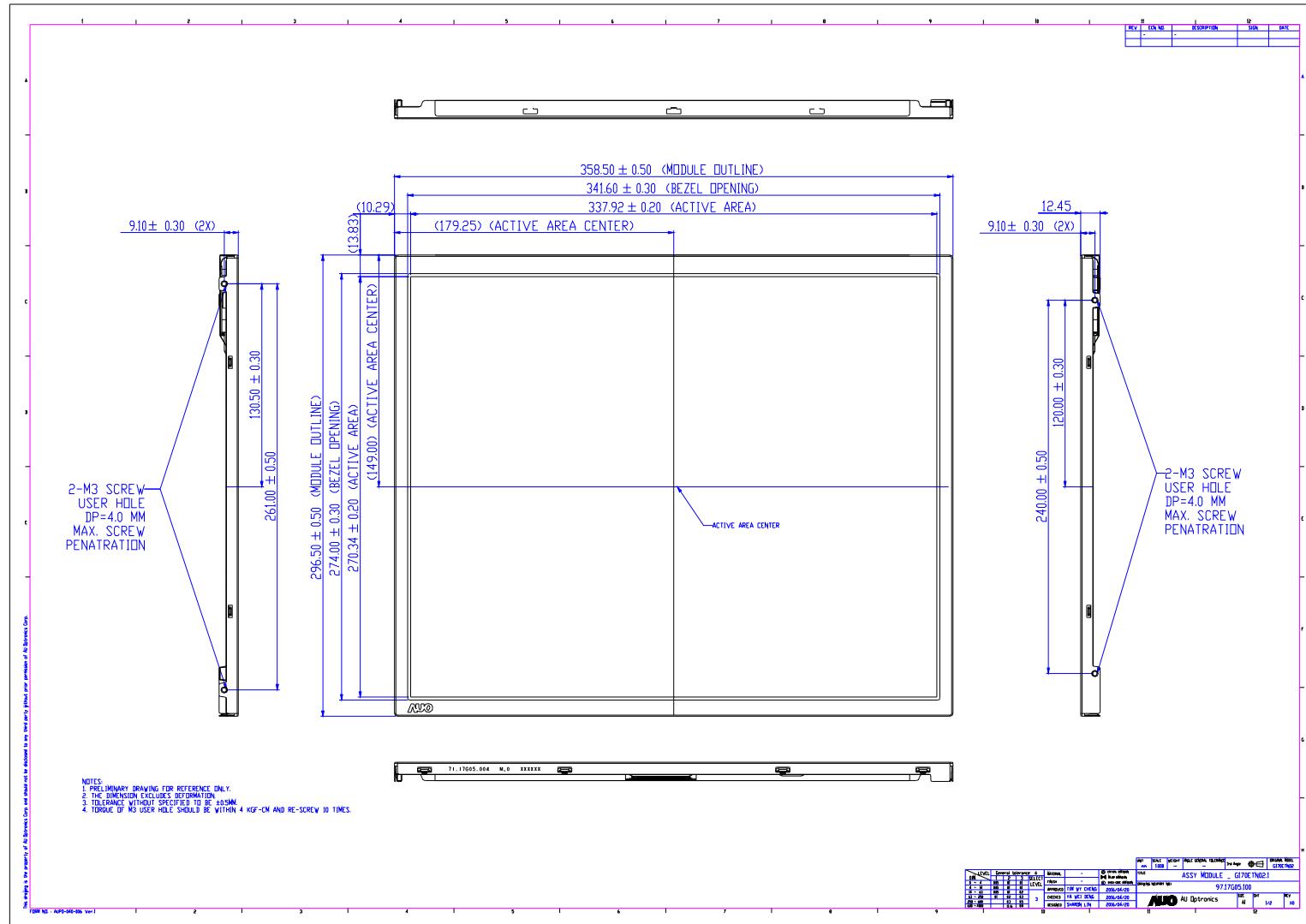




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10. Mechanical Characteristics





Product Specification

G170ETN02.1

