

ALC-270001-03-1

~ 27" High Brightness TFT LCD

2018/04/17

Engineering Specifications v.1.0

() Preliminary Specifications

(√) Final Specifications

[This specification is subject to change without notice.]

Company Confidential



| Customer Name | | Customer Approval |
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RECORD OF REVISION

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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 a TFT-LCD 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 lightbar edge. Otherwise the TFT-LCD Module may be damaged.
- 10) Insert or pull out the interface connector, be sure not to rotate nor tilt it of the TFT-LCD Module.
- 11) Do not twist nor bend the TFT -LCD Module even momentary. It should be taken into consideration that no bending/twisting forces are applied to the TFT-LCD Module from outside. Otherwise the TFT-LCD Module may be damaged.
- 12) Please avoid touching COF position while you are doing mechanical design.
- 13) When storing modules as spares for a long time, the following precaution is necessary:
Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.

2 General Description

This specification applies to the 27 inch-FHD Color a-Si TFT-LCD Module ALC-270001-03-1. The display supports the FHD - 1920(H) x 1080(V) screen format and 16.7M colors (RGB 8-bit data). The light source of this TFT-LCD module is W-LED. The input interface is Dual channel LVDS.

2.1 Display Characteristics

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

| ITEMS | Unit | SPECIFICATIONS |
|--|----------------------|---|
| Screen Diagonal | [mm] | 685.65(27.0") |
| Active Area | [mm] | 597.6 (H) x 336.15 (V) |
| Pixels H x V | - | 1920(x3) x 1080 |
| Pixel Pitch | [um] | 311.25 (per one triad) ×311.25 |
| Pixel Arrangement | - | R.G.B. Vertical island |
| Display Mode | - | VA Mode, Normally Black |
| White Luminance (Center) | [cd/m ²] | 600 (Typ) cd/m ² |
| Contrast Ratio | - | 3000 (Typ.) |
| Response Time | [msec] | 12ms (Typ., on/off) |
| Power Consumption (LCD Module + Backligh unit) | [Watt] | Total (typ): 41.7W VDD line: PDD (typ), All white pattern at 60Hz = 5.1W LED line: PBLU (typ) = 36.6W |
| Weight | [Grams] | 2180 gram (Typ.) |
| Outline Dimension | [mm] | 613.6(H)x356.85(V)x10.0(D) (Typ.) |
| Electrical Interface | - | Dual channel LVDS |
| Support Color | - | 16.7M colors (RGB 8-bit) |
| Surface Treatment | - | Anti-Glare 3H |
| Temperature Range Operating Storage (Shipping) | [°C] [°C] | 0 to +50 -20 to +60 |
| RoHS Compliance | - | RoHS Compliance |
| TCO Compliance | - | TCO 6.0 Compliance |

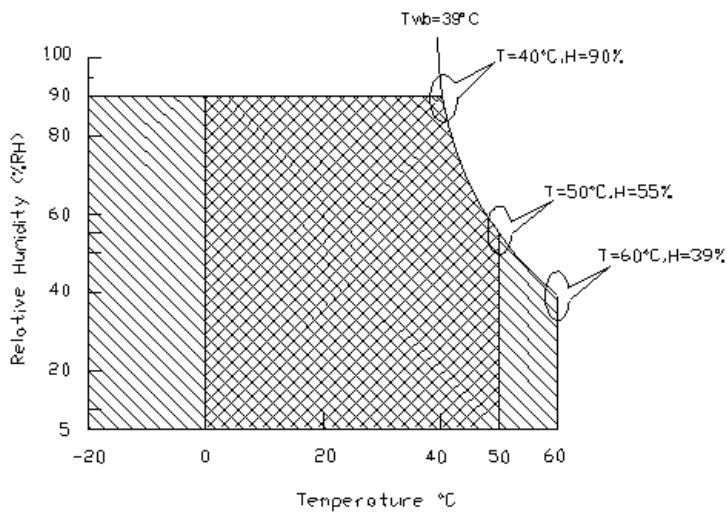
2.2 Absolute Maximum Rating of Environment

Permanent damage may occur if exceeding the following maximum rating.

| Symbol | Description | Min. | Max. | Unit | Remark |
|--------|---------------------------------------|------|------|-------|---|
| TOP | Operating Temperature | 0 | +50 | [°C] | Note 2-1 |
| TGS | Glass surface temperature (operation) | 0 | +65 | [°C] | Note 2-1 Function judged only |
| HOP | Operation Humidity | 5 | 90 | [%RH] | Note 2-1 |
| TST | Storage Temperature | -20 | +60 | [°C] | |
| HST | Storage Humidity | 5 | 90 | [%RH] | |

Note 2-1: Temperature and relative humidity range are shown as the below figure.

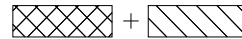
1. 90% RH Max ($T_a \leq 39^\circ\text{C}$)
2. Max wet-bulb temperature at 39°C or less. ($T_a \leq 39^\circ\text{C}$)
3. No condensation



Operating Range



Storage Range



2.3 Optical Characteristics

The optical characteristics are measured on the following test condition.

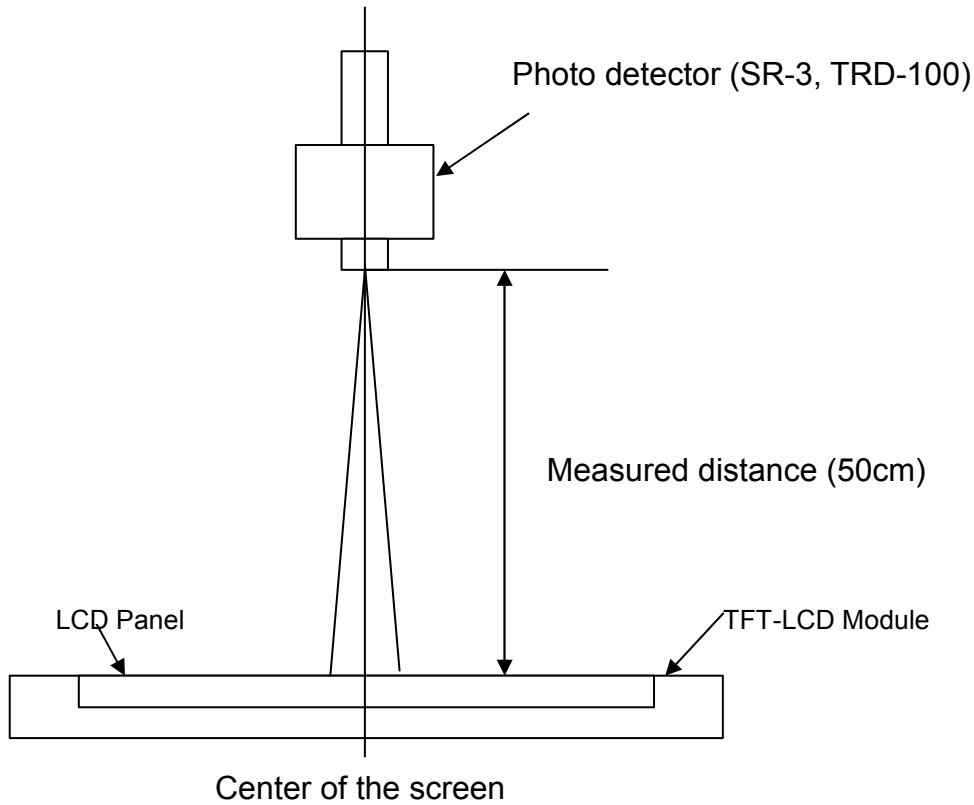
Test Condition:

1. Equipment setup: Please refer to **Note 2-2**.
2. Panel Lighting time: 30 minutes
3. VDD=5.0V, Fv=60Hz, Is=110mA (typ.), Ta=25°C

| Symbol | Description | | Min. | Typ. | Max. | Unit | Remark |
|------------|-------------------------------------|------------------|-------|-------|-------|----------------------|-------------------------------|
| L_w | White Luminance (Center of screen) | | 500 | 600 | - | [cd/m ²] | Note 2-2 By SR-3 |
| L_{uni} | Luminance Uniformity (9 points) | | 75 | 80 | - | [%] | Note 2-3 By SR-3 |
| CR | Contrast Ratio (Center of screen) | | 1800 | 3000 | - | - | Note 2-4 By SR-3 |
| θ_R | Horizontal Viewing Angle (CR=10) | Right | 150 | 178 | - | [degree] | Note 2-5 By SR-3 |
| θ_L | | Left | 150 | 178 | - | | |
| Φ_H | Vertical Viewing Angle (CR=10) | Up | 150 | 178 | - | | |
| Φ_L | | Down | 150 | 178 | - | | |
| θ_R | Horizontal Viewing Angle (CR=5) | Right | 150 | 178 | - | | |
| θ_L | | Left | 150 | 178 | - | | |
| Φ_H | Vertical Viewing Angle (CR=5) | Up | 150 | 178 | - | | |
| Φ_L | | Down | 150 | 178 | - | | |
| T_R | Response Time | Rising Time | - | 7 | 17 | [msec] | Note 2-6 By TRD-100 |
| T_F | | Falling Time | - | 5 | 7 | | |
| - | | Rising + Falling | - | 12 | 24 | | |
| R_x | Color Coordinates (CIE 1931) | Red x | 0.615 | 0.645 | 0.675 | - | By SR-3 |
| R_y | | Red y | 0.300 | 0.330 | 0.360 | | |
| G_x | | Green x | 0.285 | 0.315 | 0.345 | | |
| G_y | | Green y | 0.590 | 0.620 | 0.650 | | |
| B_x | | Blue x | 0.124 | 0.154 | 0.184 | | |
| B_y | | Blue y | 0.025 | 0.055 | 0.085 | | |
| W_x | | White x | 0.283 | 0.313 | 0.343 | | |
| W_y | | White y | 0.299 | 0.329 | 0.359 | | |
| CT | Crosstalk | | - | - | 1.5 | [%] | Note 2-7 By SR-3 |

| | | | | | | |
|-----------------|----------------------------|---|---|-----|------|----------------------------|
| F _{dB} | Flicker (Center of screen) | - | - | -20 | [dB] | Note 2-8 By SR-3 |
|-----------------|----------------------------|---|---|-----|------|----------------------------|

Note 2-2: Equipment setup :

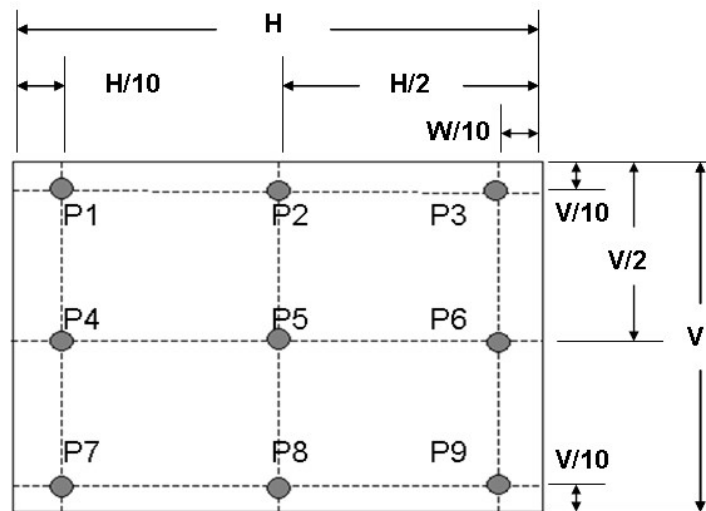


Note 2-3: Luminance Uniformity Measurement

Definition:

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance of 9 Points (P1~ P9)}}{\text{Maximum Luminance of 9 Points (P1~ P9)}}$$

a. Test pattern: White Pattern



Note 2-4: Contrast Ratio Measurement

Definition:

$$\text{Contrast Ratio} = \frac{\text{Luminance of White pattern}}{\text{Luminance of Black pattern}}$$

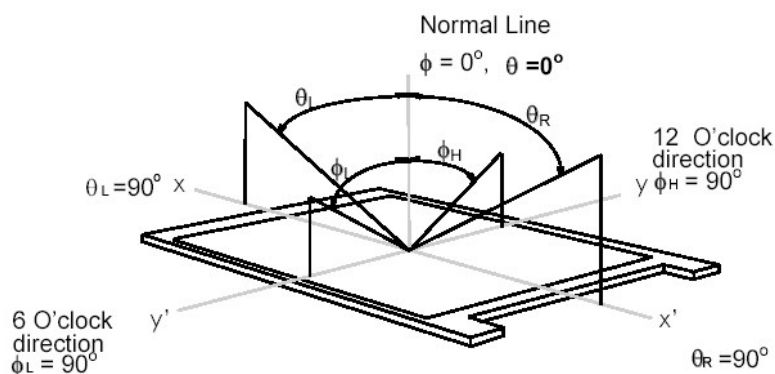
- a. Measured position: Center of screen (P5) & perpendicular to the screen ($\theta = \Phi = 0^\circ$)

Note 2-5: Viewing angle measurement

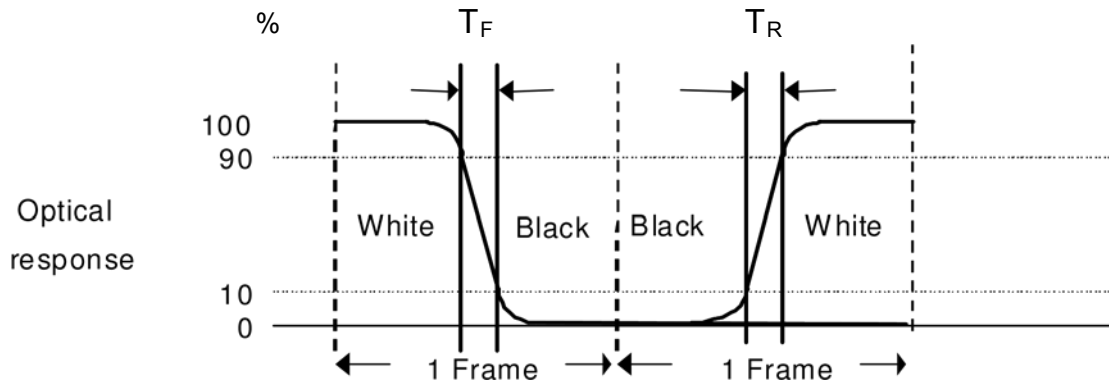
Definition: The angle at which the contrast ratio is greater than 10 & 5.

- a. Horizontal view angle: Divide to left & right (θ_L & θ_R)
Vertical
- b. view angle: Divide to up & down (Φ_H & Φ_L)

Note 2-6: Response time measurement



The output signals of photo detector are measured when the input signals are changed from “Black” to “White” (rising time, T_R), and from “White” to “Black” (falling time, T_F), respectively. The response time is interval between the 10% and 90% of optical response. (*Black & White color definition: Please refer section 3.4.3*)



Note 2-7: Crosstalk measurement

Definition:

$$CT = \text{Max. } (CT_H, CT_V);$$

Where

a. Maximum Horizontal Crosstalk :

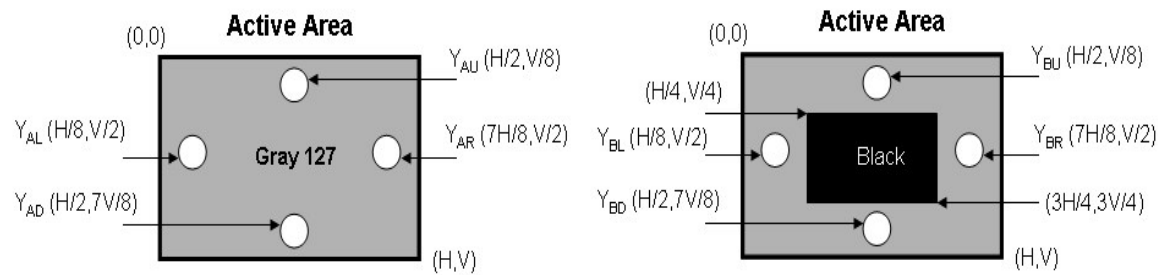
$$CT_H = \text{Max. } (| Y_{BL} - Y_{AL} | / Y_{AL} \times 100 \%, | Y_{BR} - Y_{AR} | / Y_{AR} \times 100 \%);$$

Maximum Vertical Crosstalk:

$$CT_V = \text{Max. } (| Y_{BU} - Y_{AU} | / Y_{AU} \times 100 \%, | Y_{BD} - Y_{AD} | / Y_{AD} \times 100 \%);$$

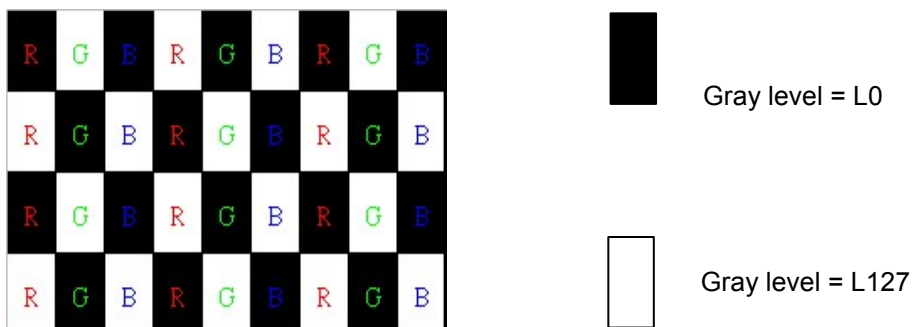
b. $Y_{AU}, Y_{AD}, Y_{AL}, Y_{AR}$ = Luminance of measured location without Black pattern

$Y_{BU}, Y_{BD}, Y_{BL}, Y_{BR}$ = Luminance of measured location with Black pattern



Note 2-8: Flicker measurement

a. Test pattern: It is listed as following.



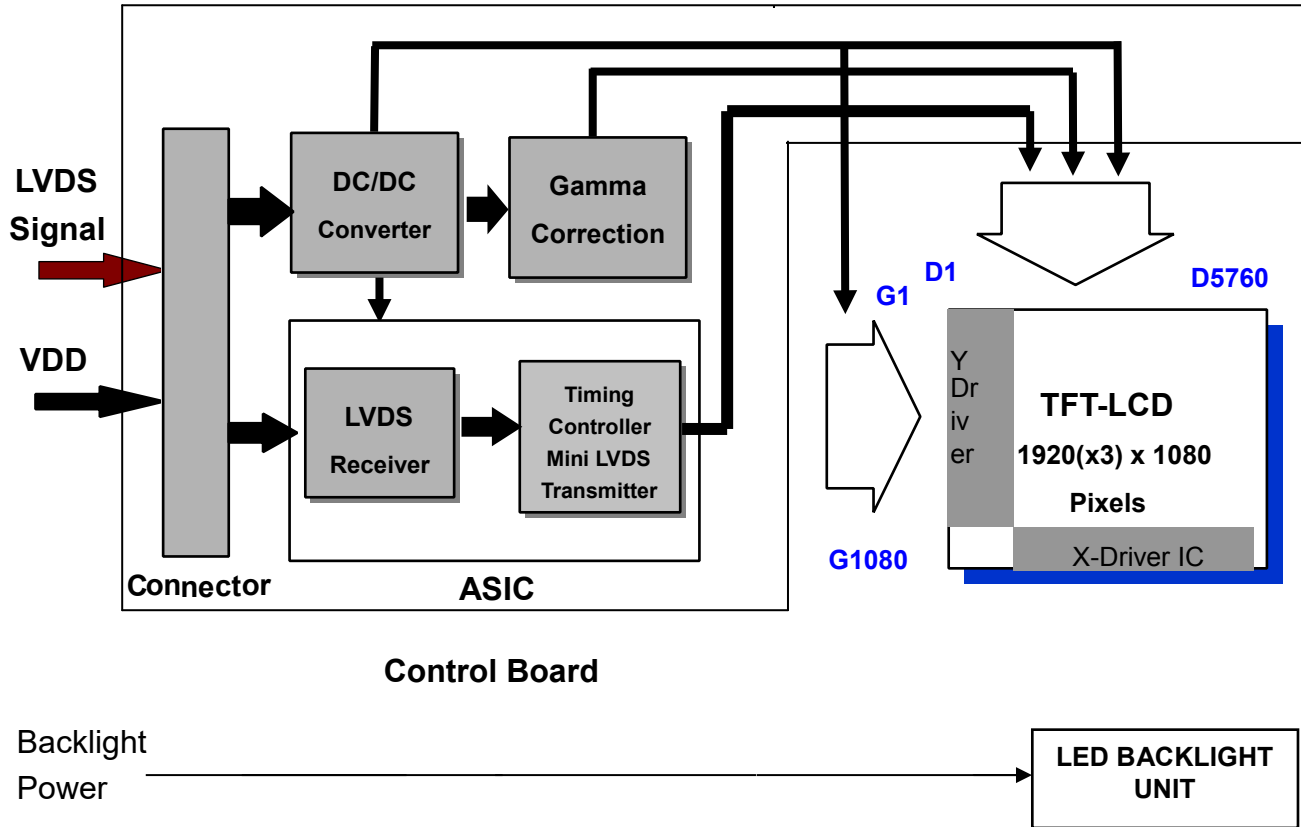
R: Red, G: Green, B:Blue

b. Measured position: Center of screen (P5) & perpendicular to the screen ($\theta=\Phi=0^\circ$)

3 TFT-LCD Module

3.1 Block Diagram

The following shows the block diagram of the 27.0 inch Color TFT-LCD Module.



3.2 Interface Connection

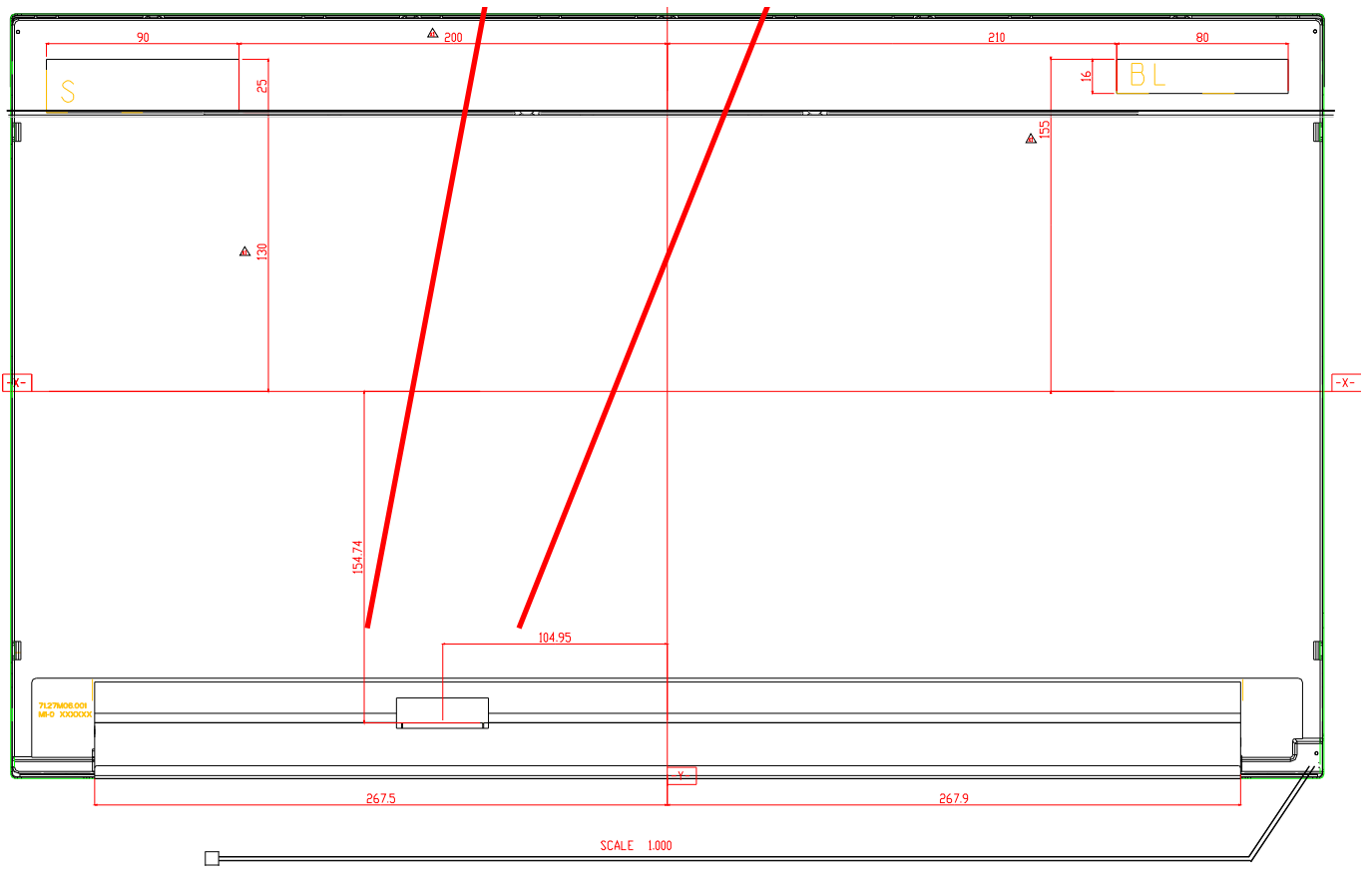
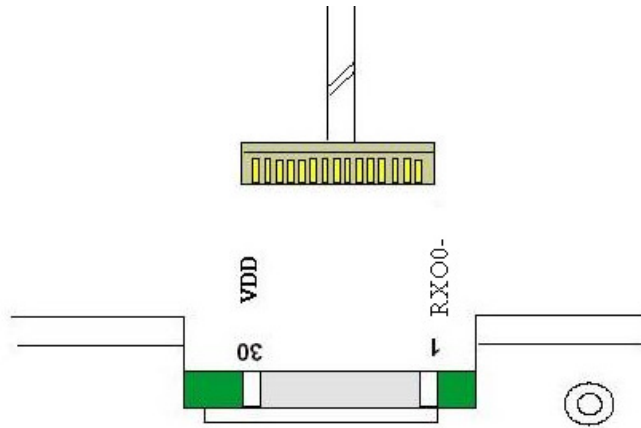
3.2.1 Connector Type

| | | | |
|-------------------|--------------|------------------------|----------------|
| TFT-LCD Connector | Manufacturer | P-TWO | STM |
| | Part Number | AL230F-A0G1D-P | MSCKT2407P30HB |
| Mating Connector | Manufacturer | JAE | |
| | Part Number | FI-X30HL (Locked Type) | |

3.2.2 Connector Pin Assignment

| 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 | Ground | |
| 25 | NC | No connection (for test only. Do not connect) | |
| 26 | NC | No connection (for test only. Do not connect) | |

| | | | |
|----|-----|---|--|
| 27 | NC | No connection (for test only. Do not connect) | |
| 28 | VDD | Power Supply Input Voltage | |
| 29 | VDD | Power Supply Input Voltage | |
| 30 | VDD | Power Supply Input Voltage | |



3.3 Electrical Characteristics

3.3.1 Absolute Maximum Rating

Permanent damage may occur if exceeding the following maximum rating.

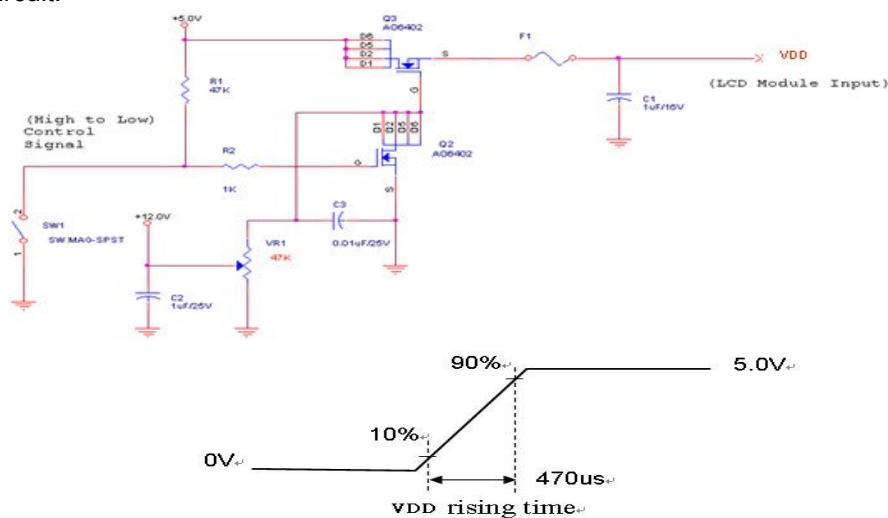
| Symbol | Description | Min | Max | Unit | Remark |
|--------|----------------------------|---------|-----|--------|---------|
| VDD | Power Supply Input Voltage | GND-0.3 | 6.0 | [Volt] | Ta=25°C |

3.3.2 Recommended Operating Condition

| Symbol | Description | Min | Typ | Max | Unit | Remark |
|--------|----------------------------------|-----|------|------|--------|-----------------------------------|
| VDD | Power supply Input voltage | 4.5 | 5.0 | 5.5 | [Volt] | |
| IDD | Power supply Input Current (RMS) | - | 1.02 | 1.22 | [A] | VDD= 5.0V, Black Pattern, Fv=60Hz |
| | | | 1.21 | 1.45 | [A] | VDD= 5.0V, Black Pattern, Fv=75Hz |
| PDD | VDD Power Consumption | - | 5.1 | 6.12 | [Watt] | VDD= 5.0V, Black Pattern, Fv=60Hz |
| | | | 6.05 | 7.26 | [Watt] | VDD= 5.0V, Black Pattern, Fv=75Hz |
| IRush | Inrush Current | - | - | 3.0 | [A] | Note 3-1 |
| VDDrp | Allowable VDD Ripple Voltage | - | - | 500 | [mV] | VDD= 5.0V, Black Pattern, Fv=75Hz |

Note 3-1: Inrush Current measurement:

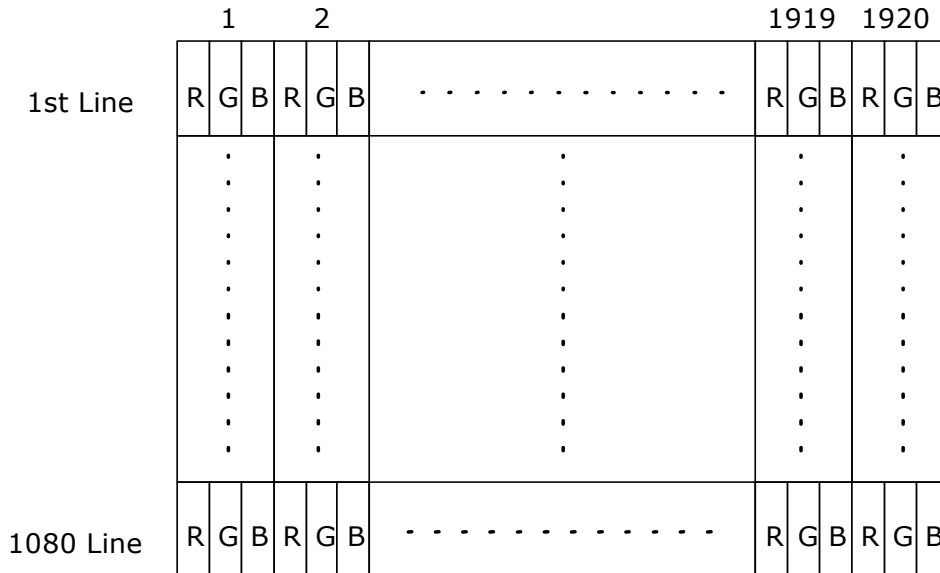
Test circuit:



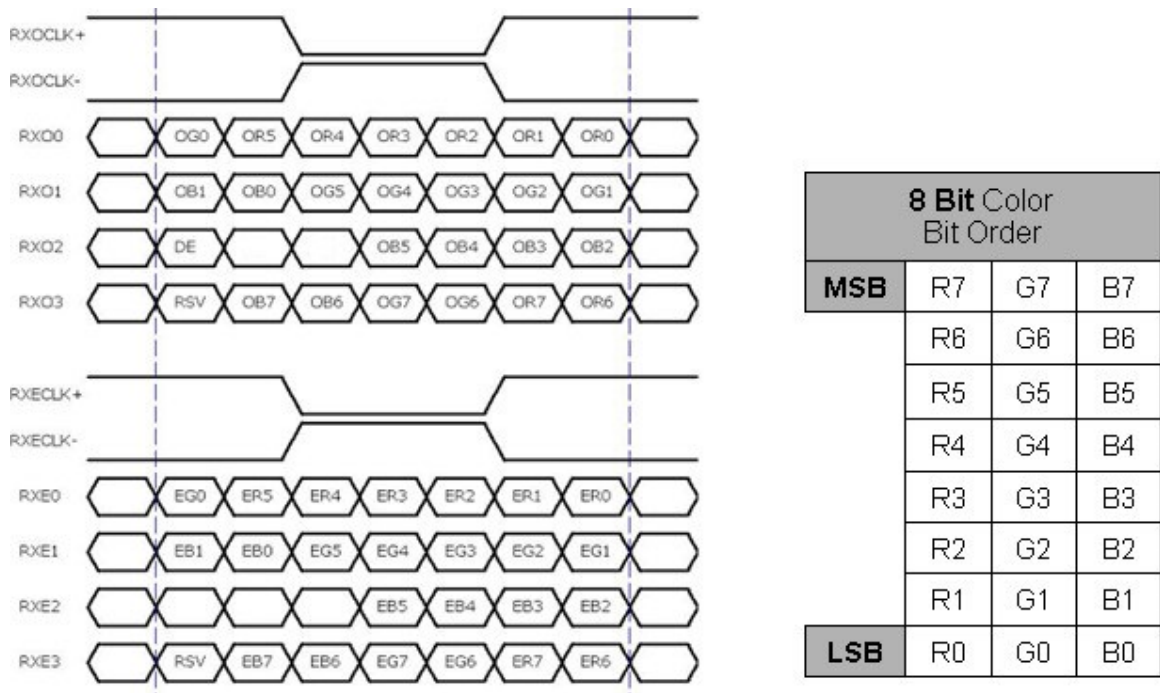
The duration of VDD rising time: 470us.

3.4 Signal Characteristics

3.4.1 LCD Pixel Format



3.4.2 LVDS Data Format



Note 3-2:

- a. O = "Odd Pixel Data" E = "Even Pixel Data"
- b. Refer to 3.4.1 LCD pixel format, the 1st data is 1 (Odd Pixel Data), the 2nd data is 2 (Even Pixel Data) and the last data is 1920 (Even Pixel Data).

3.4.3 Color versus Input Data

The following table is for color versus input data (8bit). The higher the gray level, the brighter the color.

| Color | Gray Level | Color Input Data | | | | | | | | | | | | | | | | | | | | Remark | | | | |
|----------|------------|------------------------------|----|----|----|----|----|----|----|--------------------------------|----|----|----|----|----|----|----|-------------------------------|----|----|----|--------|----|----|----|-------|
| | | RED data (MSB:R7, LSB:R0) | | | | | | | | GREEN data (MSB:G7, LSB:G0) | | | | | | | | BLUE data (MSB:B7, LSB:B0) | | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | | B3 | B2 | B1 | B0 |
| Black | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| White | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gray 127 | - | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Red | L0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Black |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | L255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Green | L0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Black |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | L255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Blue | L0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Black |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | |
| | L255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

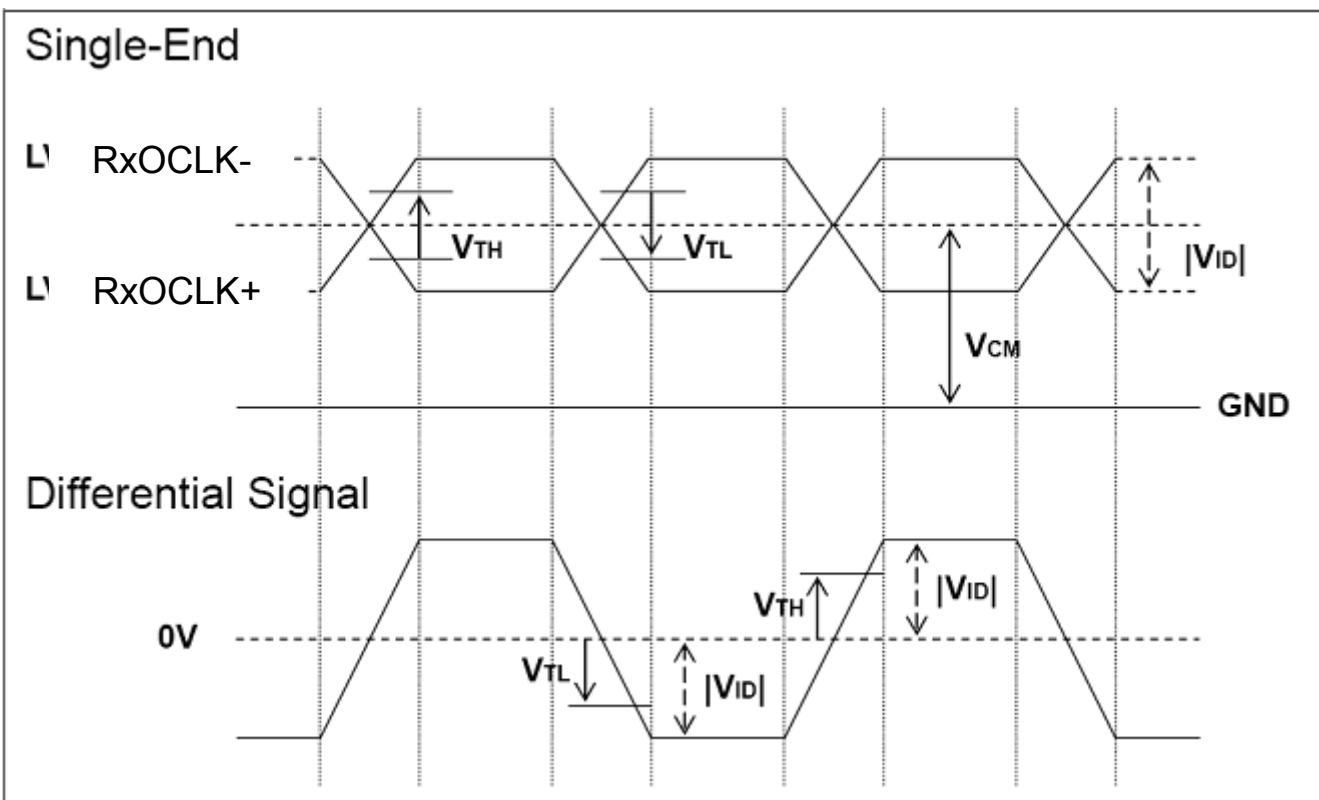
3.4.4 LVDS Specification

a. DC Characteristics:

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

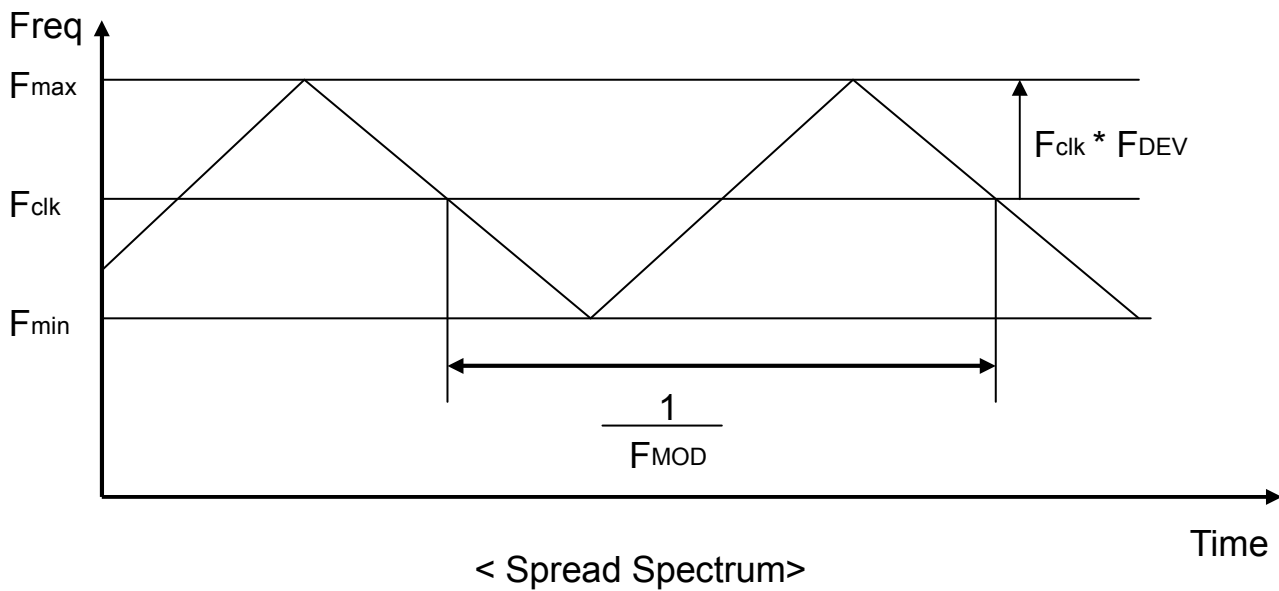
LVDS Signal Waveform:

Use RxOCLK- & RxOCLK+ as example.



b. AC Characteristics:

| Symbol | Description | Min | Max | Unit | Remark |
|-----------|--|-----|---------|------|--------|
| F_{DEV} | Maximum deviation of input clock frequency during Spread Spectrum | - | ± 3 | % | |
| F_{MOD} | Maximum modulation frequency of input clock during Spread Spectrum | - | 200 | KHz | |



Fclk: LVDS Clock Frequency

3.4.5 Input Timing Specification

It only support DE mode, and the input timing are shown as the following table.

| Symbol | Description | | Min. | Typ. | Max. | Unit | Remark |
|-----------|--------------------|-----------|------|------|------|------|-----------------|
| Tv | Vertical Section | Period | 1092 | 1130 | 1793 | Th | |
| Tdisp (v) | | Active | 1080 | 1080 | 1080 | Th | |
| Tblk (v) | | Blanking | 12 | 50 | 713 | Th | |
| Fv | | Frequency | 50 | 60 | 76 | Hz | |
| Th | Horizontal Section | Period | 1004 | 1050 | 1100 | Tclk | |
| Tdisp (h) | | Active | 960 | 960 | 960 | Tclk | |
| Tblk (h) | | Blanking | 44 | 90 | 140 | Tclk | |
| Fh | | Frequency | 55 | 68 | 90 | KHz | Note 3-3 |
| Tclk | LVDS Clock | Period | 11.1 | 14.0 | 18.2 | ns | 1/Fclk |
| Fclk | | Frequency | 54.8 | 71.2 | 90.0 | MHz | Note 3-4 |

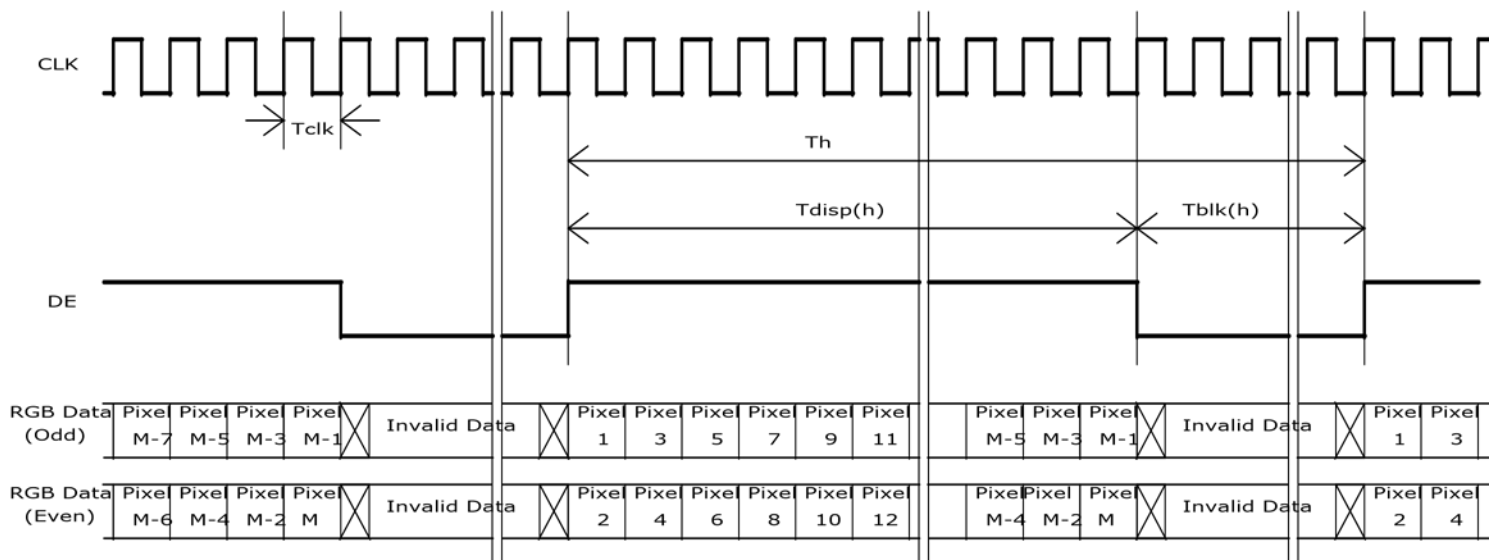
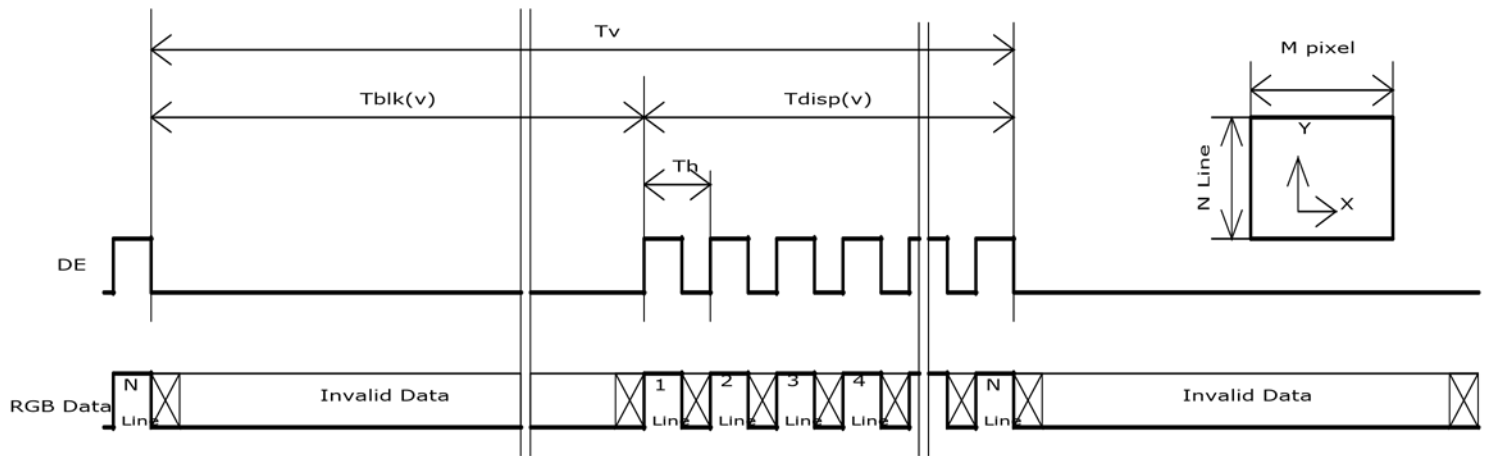
Note 3-3: The equation is listed as following. Please don't exceed the above recommended value.

$$\begin{aligned} Fh (\text{Min.}) &= Fclk (\text{Min.}) / Th (\text{Min.}); \\ Fh (\text{Typ.}) &= Fclk (\text{Typ.}) / Th (\text{Typ.}); \\ Fh (\text{Max.}) &= Fclk (\text{Max.}) / Th (\text{Min.}); \end{aligned}$$

Note 3-4: The equation is listed as following. Please don't exceed the above recommended value.

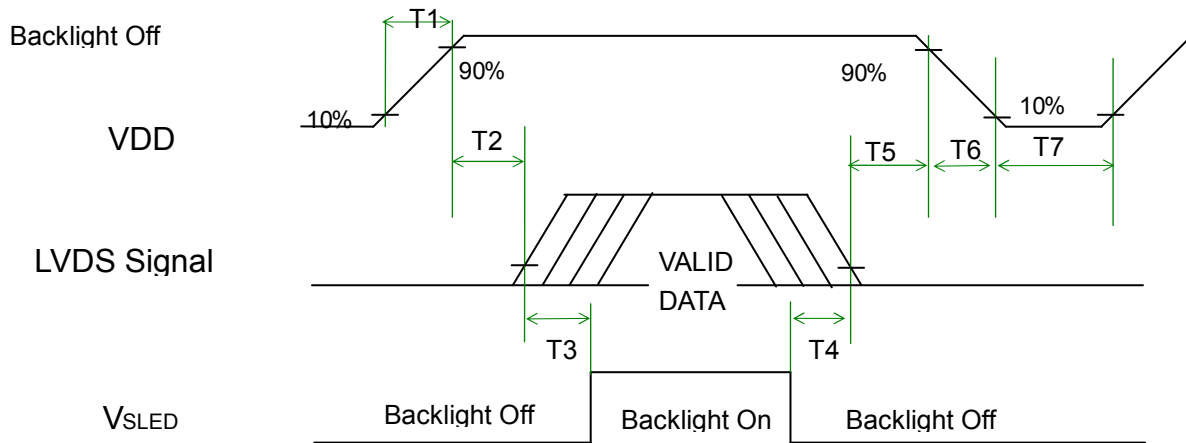
$$\begin{aligned} Fclk (\text{Min.}) &= Fv (\text{Min.}) \times Th (\text{Min.}) \times Tv (\text{Min.}); \\ Fclk (\text{Typ.}) &= Fv (\text{Typ.}) \times Th (\text{Typ.}) \times Tv (\text{Typ.}); \\ Fclk (\text{Max.}) &= Fv (\text{Max.}) \times Th (\text{Typ.}) \times Tv (\text{Typ.}); \end{aligned}$$

3.4.6 Input Timing Diagram



3.5 Power ON/OFF Sequence

VDD power, LVDS signal and backlight on/off sequence are as following. LVDS signals from any system shall be Hi-Z state when VDD is off.



Power Sequence Timing

| Symbol | Value | | | Unit | Remark |
|--------|-------|------|------|------|------------------------------------|
| | Min. | Typ. | Max. | | |
| T1 | 0.5 | - | 10 | [ms] | |
| T2 | 0 | - | 50 | [ms] | |
| T3 | 500 | - | - | [ms] | |
| T4 | 100 | - | - | [ms] | |
| T5 | 0 | | 50 | [ms] | Note 3-5 Note 3-6 |
| T6 | 5 | - | 100 | [ms] | Note 3-6 |
| T7 | 1000 | - | - | [ms] | |

Note 3-5 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note 3-6 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

4 Backlight Unit

4.1 Backlight

The 27.0 inch Backlight Unit includes 70pcs LED in the LED light bar.

4.2 Interface Connection

4.2.1 Connector Type

| | | |
|---------------------|--------------|-------------------|
| Backlight Connector | Manufacturer | JST or compatible |
| | Part Number | PHR-2 |
| Mating Connector | Manufacturer | JST or compatible |
| | Part Number | S2B-PH-SM4-TB |

4.2.2 Connector Pin Assignment

| Pin# | Symbol | Description | Remark |
|------|------------|-------------|---------|
| 1 | Anode(+) | Power | (Red) |
| 2 | Cathode(-) | GND | (White) |

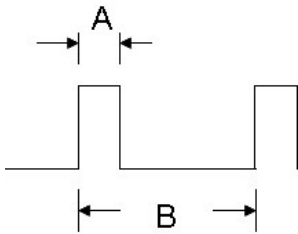
4.3 Electrical Characteristics

4.3.1 Absolute Maximum Rating

Permanent damage may occur if exceeding the following maximum rating.

(Ta=25°C)

| Symbol | Description | Val | AU | Unit | Remark |
|--------|--------------------|------|----|------|--------|
| Is | LED String Current | 1220 | | [mA] | |



Duty ratio= (A / B) X 100% ; (A: Pulse time, B: Period)

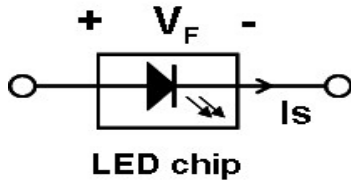
4.3.2 Recommended Operating Condition

(Ta=25°C)

| Symbol | Description | Min. | Typ. | Max. | Unit | Remark |
|-------------------|---------------------------------|------|--------|------|--------|--|
| Is | LED String Current | - | | | [mA] | |
| Vs | LED String Voltage | 29 | ... | 34 | [Volt] | Is=1220 mA ratio; Note 4-1 Note 4-5 |
| P _{BLU} | LED Light Bar Power Consumption | - | .. | 47.6 | [Watt] | Note 4-3 |
| LT _{LED} | LED Life Time | - | 70,000 | - | [Hour] | Note 4-4 |

Note 4-1: V_s (Typ.) = V_F (Typ.) X LED No. (one string);

- a. V_F : LED chip forward voltage, V_F (Min.)=2.8V, V_F (Typ.)=3.2V, V_F (Max.)=3.4V
- b. The same equation to calculate V_s (Min.) & V_s (Max.) for respective V_F (Min.) & V_F (Max.);



Note 4-2: ΔV_s (Max.) = ΔV_F X LED No. (one string);

- a. ΔV_F : LED chip forward voltage deviation; (0.2 V , each Bin of LED V_F)

Note 4-3: P_{BLU} (Typ.) = V_s (Typ.) X I_s (Typ.)

$$P_{BLU} \text{ (Max.)} = V_s \text{ (Max.)} \times I_s \text{ (Typ.)}$$

Note 4-4: Definition of life time:

- a. Brightness of LED becomes to 50% of its original value
- b. Test condition: $I_s = 1220\text{mA}$ and 25(Room Temperature)
should be 10% higher than max. value of LED string voltage (V_s) at least. °C

Note 4-5: Recommendation for LED driver power design:

Due to there are electrical property deviation in LED & monitor set system component after long time operation. strongly recommend the design value of LED driver board OVP (over voltage protection)

5 Reliability Test

reliability test items are listed as following table. (*Bare Panel only*)

| Items | Condition | Remark |
|----------------------------------|---|-----------------|
| Temperature Humidity Bias (THB) | Ta= 50°C , 80%RH, 300hours | |
| High Temperature Operation (HTO) | Ta= 50°C , 50%RH, 300hours | |
| 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 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) | |
| Drop Test | Height: 60 cm, package test | |
| Thermal Shock Test (TST) | -20 /30min, 60 /30min, 100 cycles | Note 5-1 |
| On/Off Test | On/10sec, Off/10sec, 30,000 cycles | |
| ESD (Electro Static Discharge) | Contact Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point. | Note 5-2 |
| | Air Discharge: ± 15KV, 150pF(330°C °C Ω) 1sec 8 points, 25 times/ point. | |
| Altitude Test | Operation:18,000 ft Non-Operation:40,000 ft | |

Note 5-1: a. 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.

b. After finish temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

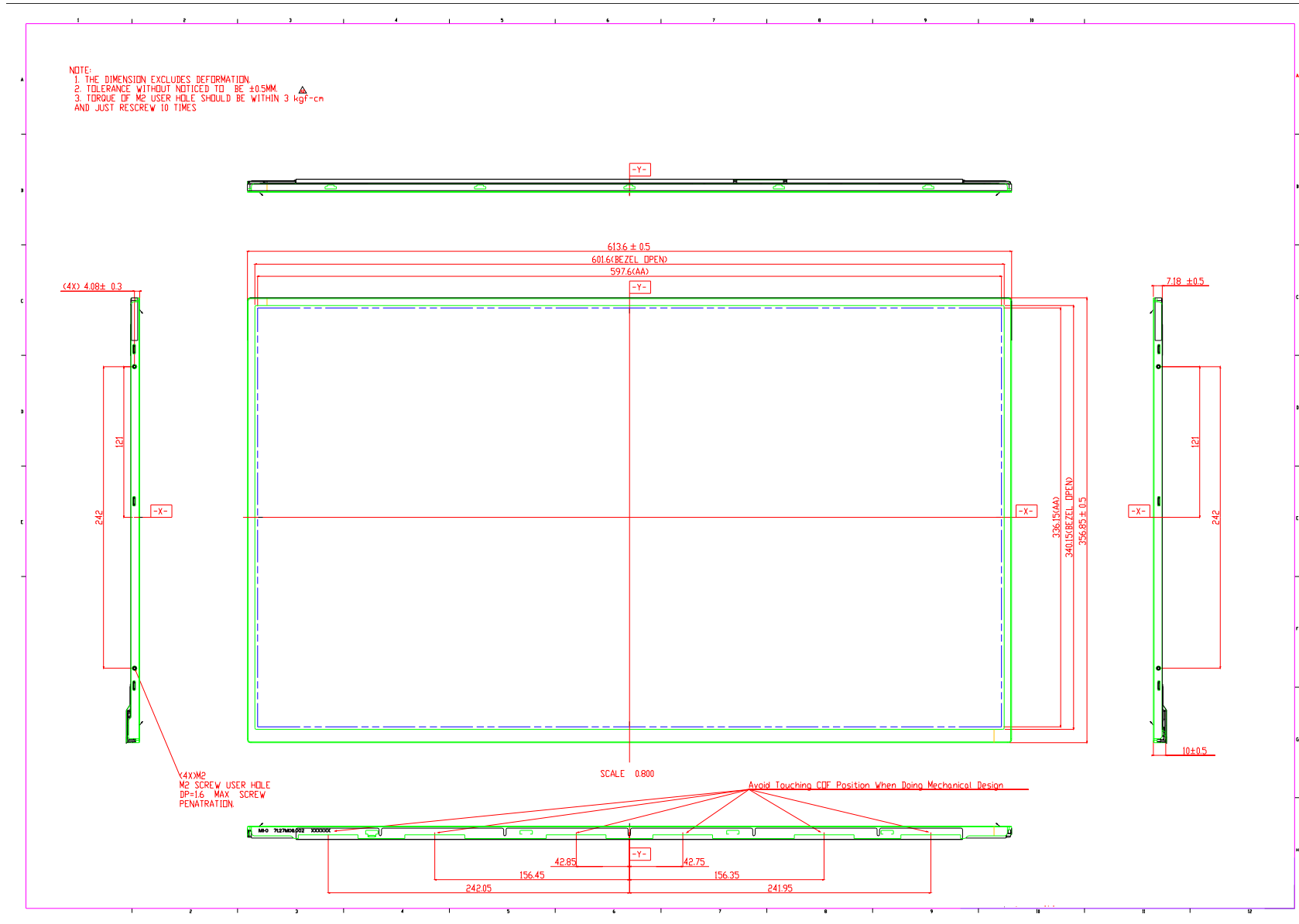
Note 5-2: EN61000-4-2, ESD class B: Certain performance degradation allowed

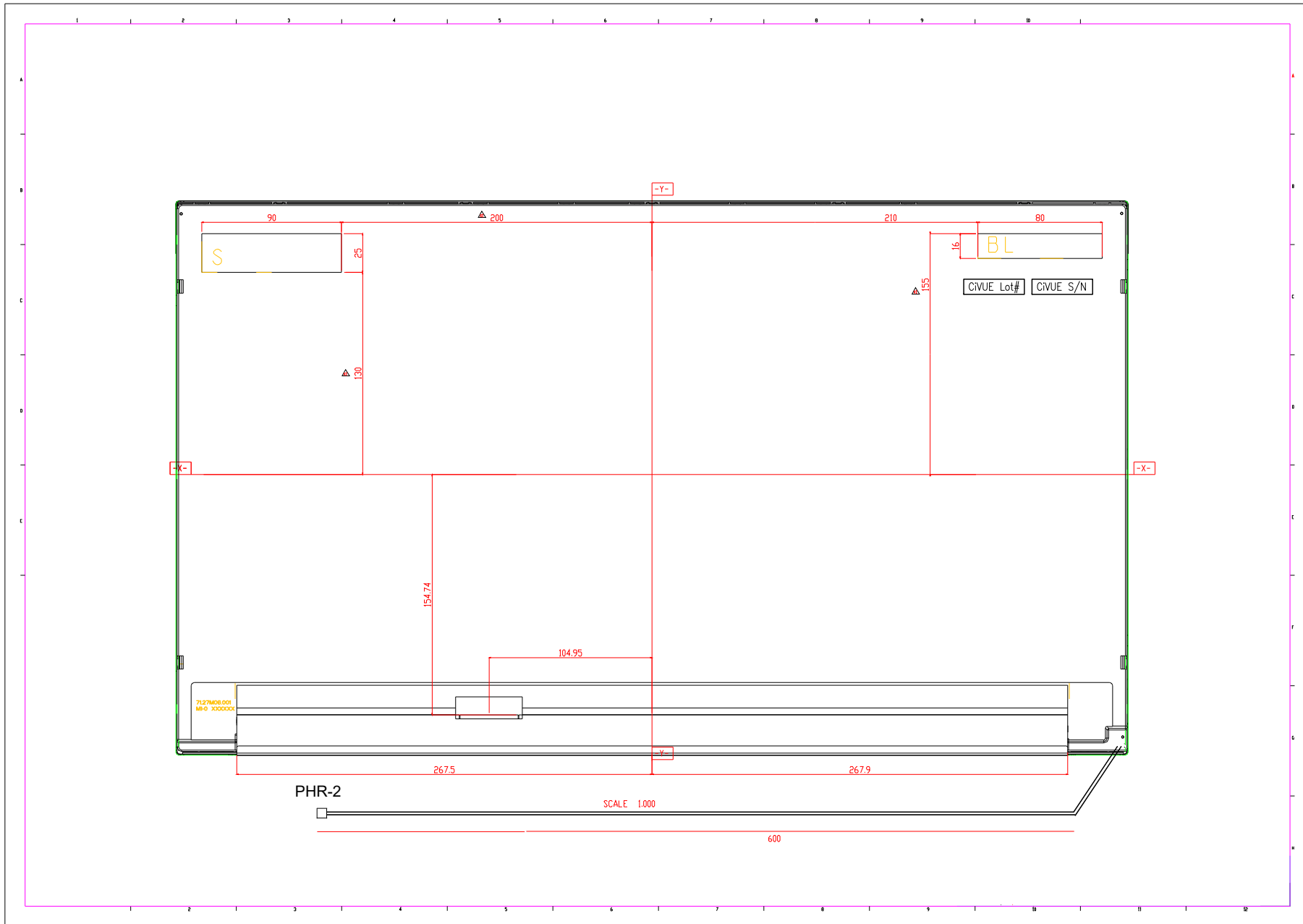
No data lost

Self-recoverable

No hardware failures.

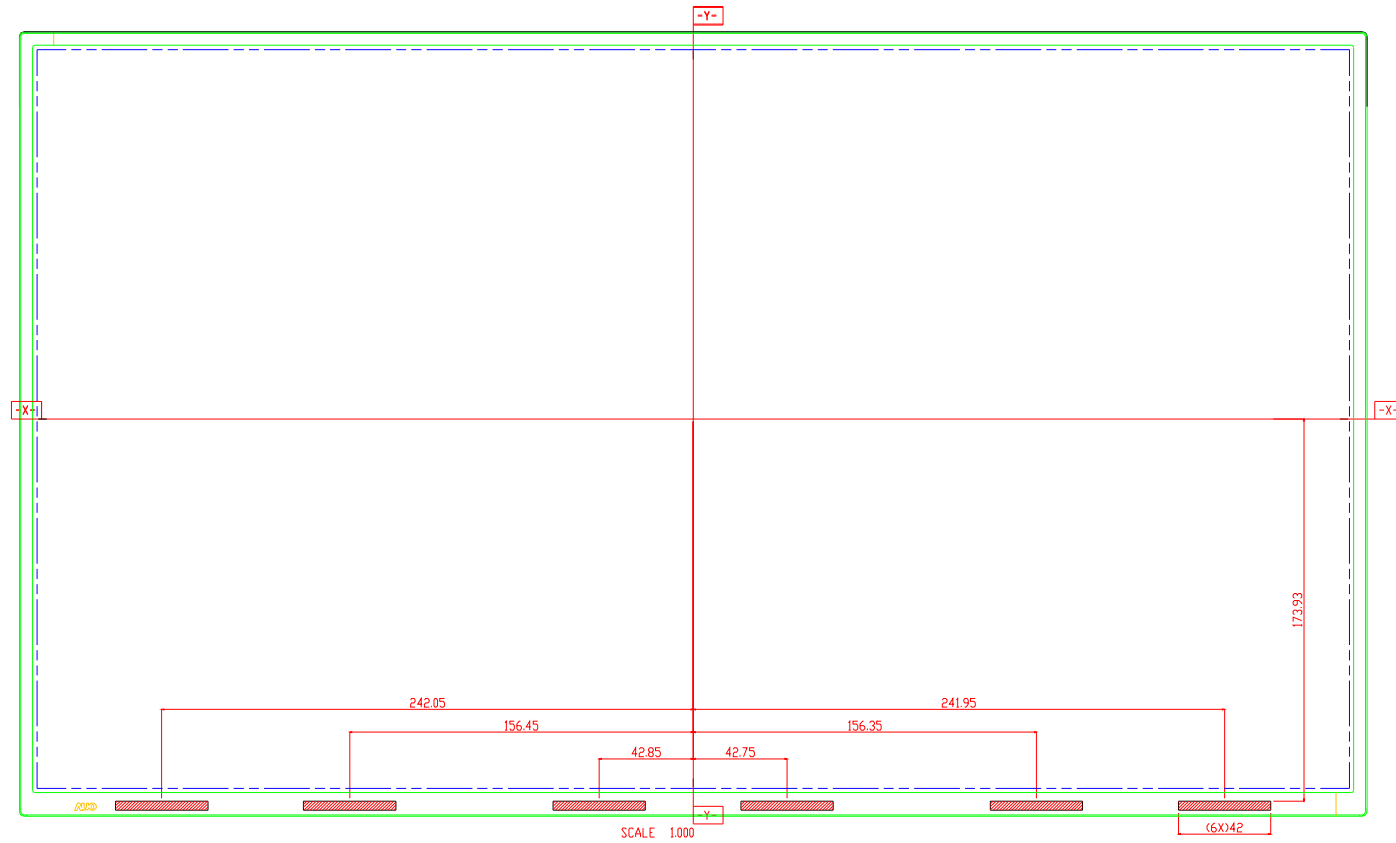
6 Mechanical Characteristics





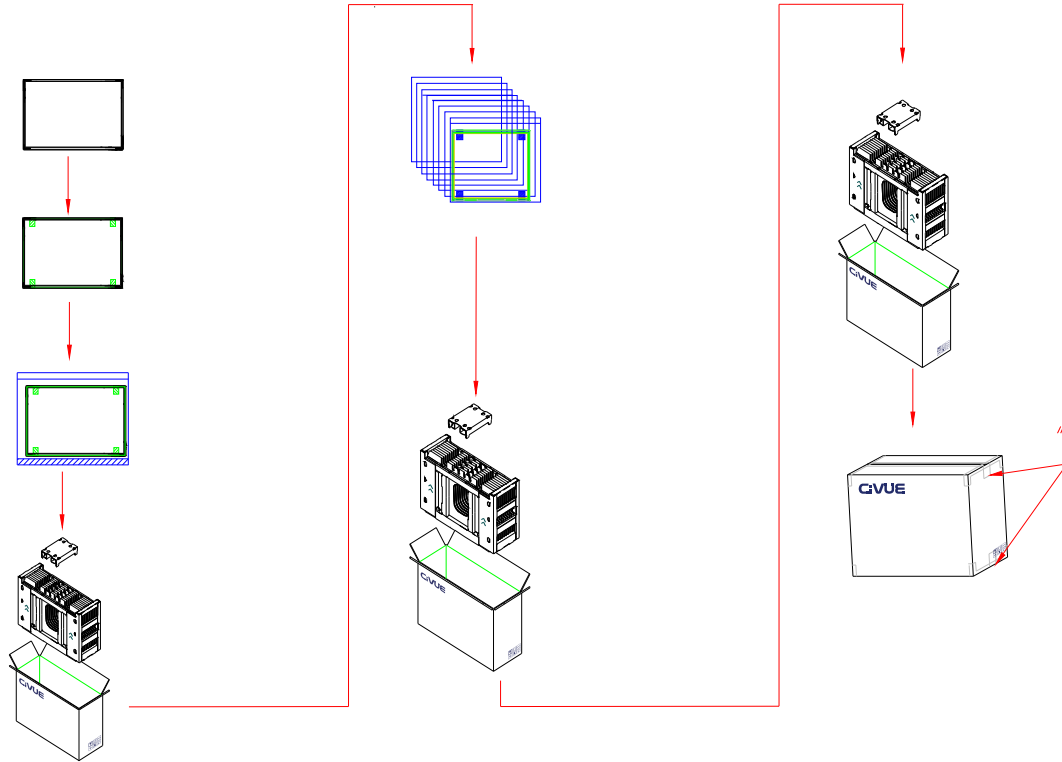
Avoid touching COF position when doing mechanical design

| REV | CON NO | DESCRIPTION | ISS | DATE |
|-----|--------|-------------|-----|------|
| - | - | - | - | - |



7 Packing Specification

7.1 Packing Flow



7.2 Pallet and shipment information

| Item | Specification | | | Remark |
|----------------------|----------------|------------------------------------|------------|-------------------------|
| | Q'ty | Dimension | Weight(kg) | |
| Panel | 1 | 613.6(H)mm x 356.85(V)mm x 10(D)mm | 2.180 | |
| Cushion | 1 | - | 4.41 | |
| Box | 1 | 708(L)mm x 261(W)mm x 473(H)mm | 1.38 | without Panel & cushion |
| Packing Box | 10 pcs/Box | 708(L)mm x 261(W)mm x 473(H)mm | 27.13 | with panel & cushion |
| Pallet | 1 | 1070(L)mm x 740(W)mm x 138(H)mm | 12.9 | |
| Pallet after Packing | 8 Boxes/pallet | 1070(L)mm x 740(W)mm x 138(H)mm | 229.94 | |

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