



PRODUCT SPECIFICATION



- Tentative Specification
- Preliminary Specification
- Approval Specification

Model NO. : PV013305KSG30F

Customer:

| | |
|--------------------|------------------|
| APPROVED BY | SIGNATURE |
| Name / Title | |
| Note | |

Please return 1 copy for your confirmation with your signature and comments.

| | | |
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| Approved By | Checked By | Prepared By |
| | | |



1. Application

This specification applies to a color TFT-LCD Module, PV013305KSG30F

2. Overview

This module is a color active matrix LCD module incorporating Oxide TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, a control circuit and power supply circuit. Graphics and texts can be displayed on a 1920×3×1080 dots panel with 16,777,216 colors by using eDP (Embedded Display Port) Ver1.2 interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving.

In this TFT-LCD panel, color filters for excellent color performance is incorporated to realize brighter and clearer pictures, making this module optimum for use in multi-media applications.

Optimum viewings are in all directions.

eDP transfer rate specification: 2.7Gbps/2 lane.

3. Mechanical specifications.

| Parameter | Specification | Unit | Note |
|--------------------------------------|---|-------|------|
| Display size | 337 (Diagonal) | mm | |
| | 13.3 (Diagonal) | inch | |
| Active area | 293.76(H) × 165.24(V) | mm | |
| Pixel Format | 1920(H) × 1080(V) (1pixel = R + G + B dot) | pixel | |
| Pixel pitch | 0.153(H) x 0.153 (V) | mm | |
| Pixel configuration | R, G, B vertical stripe | | |
| Display mode | Normally black | | |
| Surface treatment of front polarizer | Anti-glare coating: (3H) | | |

Outline dimensions

| Parameter | Min. | Typ. | Max. | Unit | Remark | |
|-------------------------|--------|--------|--------|--------|--------|-----------|
| Unit outline dimensions | Width | 307.4 | 307.6 | 307.8 | mm | |
| | Height | 182.85 | 183.05 | 183.25 | mm | |
| | Depth | 5.3 | 5.5 | 5.7 | mm | [Note3-1] |
| Mass | | | TBD | g | | |

[Note 3-1] With shading tape, without warpage and deflection.



4. Input Terminals

4-1 Driving interface of PWB

CN1 (eDP signals, +3.3V DC power supply and B/L power supply)

| Pin No. | Symbol | I/O | Function | Remark |
|---------|-----------|-----|-------------------------------------|-------------|
| 1 | NC | - | NC(NOT USE) | [Note4-1-1] |
| 2 | H_GND | P | High Speed Ground | [Note4-1-2] |
| 3 | Lane1_N | I | Complement Signal Link Lane 1 | |
| 4 | Lane1_P | I | True Signal Link Lane 1 | |
| 5 | H_GND | P | High Speed Ground | [Note4-1-2] |
| 6 | Lane0_N | I | Complement Signal Link Lane 0 | |
| 7 | Lane0_P | I | True Signal Link Lane 0 | |
| 8 | H_GND | P | High Speed Ground | [Note4-1-2] |
| 9 | AUX_CH_P | I | True Signal Auxiliary Channel | |
| 10 | AUX_CH_N | I | Complement Signal Auxiliary Channel | |
| 11 | H_GND | P | High Speed Ground | [Note4-1-2] |
| 12 | LCD_VCC | P | LCD logic and driver power(3.3V) | |
| 13 | LCD_VCC | P | LCD logic and driver power(3.3V) | |
| 14 | NC | - | NC(NOT USE) | [Note4-1-1] |
| 15 | LCD_GND | P | LCD logic and driver ground | |
| 16 | LCD_GND | P | LCD logic and driver ground | |
| 17 | HPD | O | HPD Signal | [Note4-1-3] |
| 18 | LED-1 | P | Backlight LED- | |
| 19 | LED-2 | P | Backlight LED- | |
| 20 | LED-3 | P | Backlight LED- | |
| 21 | LED-4 | P | Backlight LED- | |
| 22 | LED_PWMO | O | BL/LED PWM OUT | |
| 23 | LED_PWM I | I | BL/LED PWM IN | [Note4-1-4] |
| 24 | NC | - | NC(NOT USE) | [Note4-1-1] |
| 25 | NC | - | NC(NOT USE) | [Note4-1-1] |
| 26 | LED-5 | P | Backlight LED- | |
| 27 | LED-6 | P | Backlight LED- | |
| 28 | BL_PWR | P | Backlight power | |
| 29 | BL_PWR | P | Backlight power | |
| 30 | NC | - | NC(NOT USE) | [Note4-1-1] |

*1 P: POWER I: Input O: Output

[Note 4-1-1] Don't input any signals or any powers into a NC pin. Keep the NC pin open.

[Note 4-1-2] The shielding case is connected with signal GND.

• Connector used :20455-030E-76 (I-PEX)

• Corresponding connector : 20453-030T (I-PEX)

(Sanstar is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)



The equivalent circuit figure of the terminal.

[Note 4-1-3]

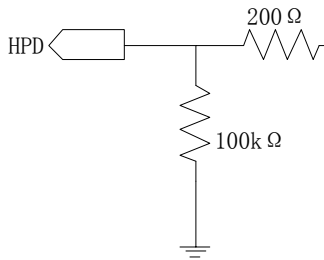


Fig.4-1-1 Equivalent circuit (Pin No.17)

[Note 4-1-4]

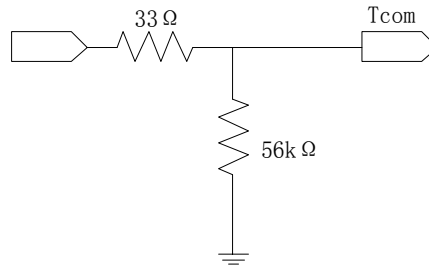


Fig.4-1-2 Equivalent circuit (Pin No.23)

4-2eDP interface

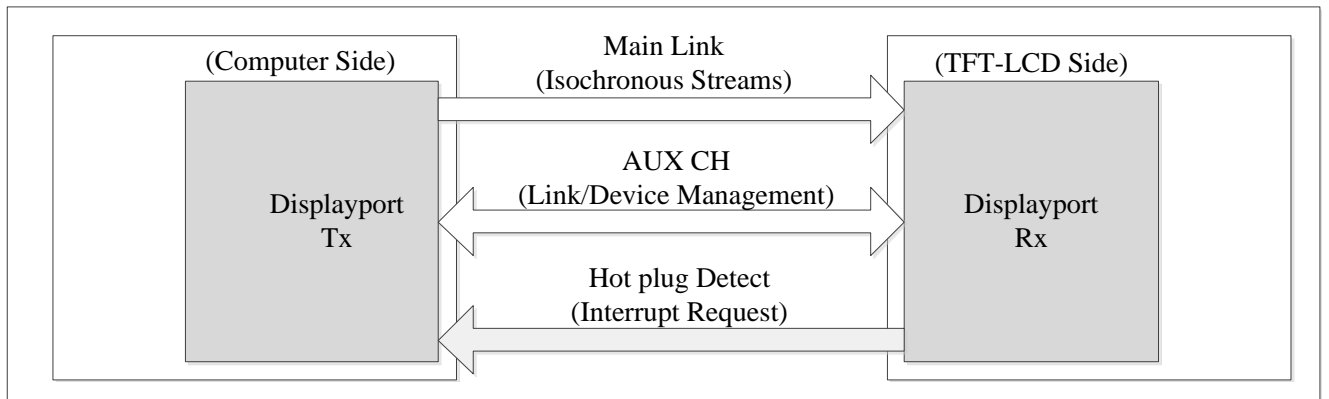


Fig.4-2-1 DP architecture

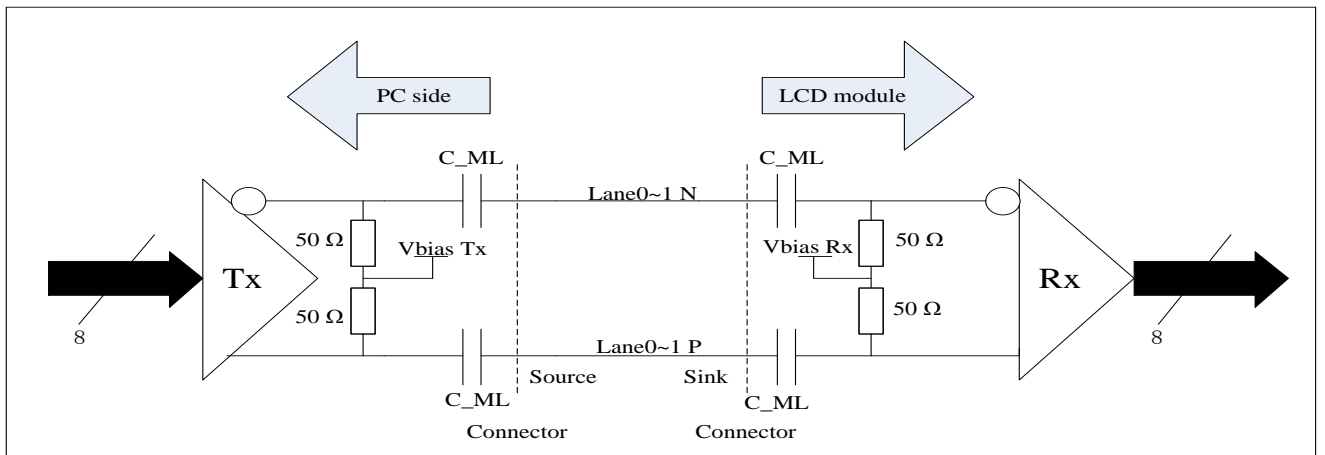


Fig.4-2-2 Main Link differential pair

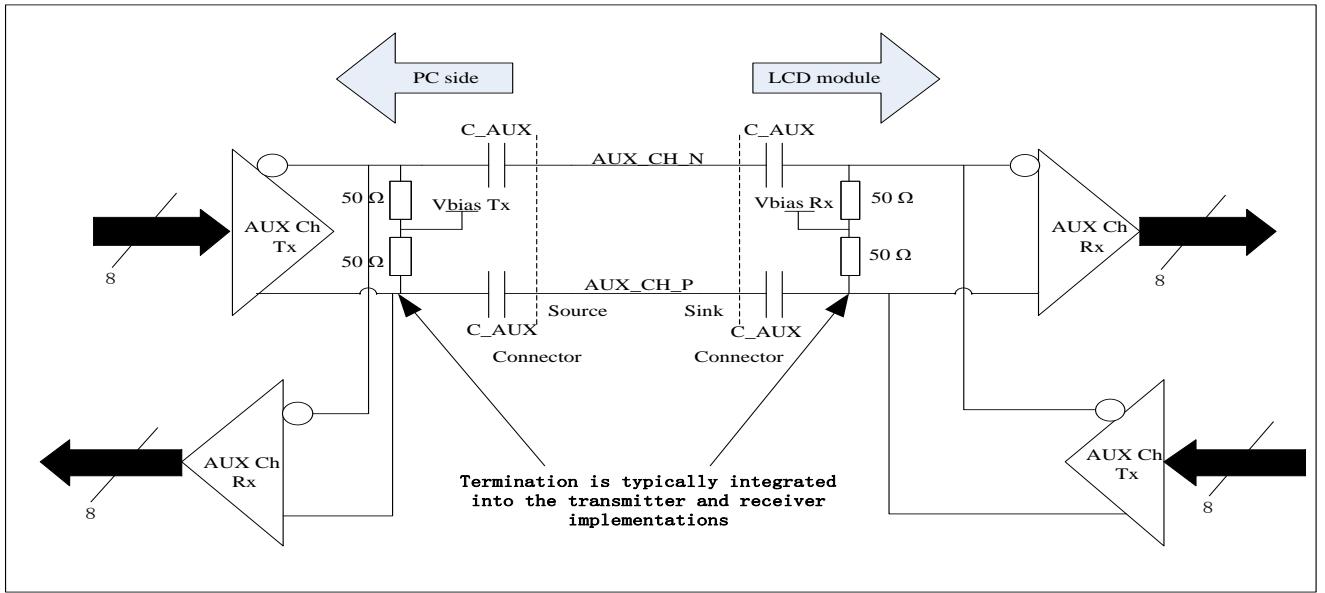


Fig.4-2-3 AUX Link differential pair

| Lane0 | Lane1 |
|--------|--------|
| R0-7:0 | R1-7:0 |
| G0-7:0 | G1-7:0 |
| B0-7:0 | B1-7:0 |
| R2-7:0 | R3-7:0 |
| G2-7:0 | G3-7:0 |
| B2-7:0 | B3-7:0 |
| R4-7:0 | R5-7:0 |
| G4-7:0 | G5-7:0 |
| B4-7:0 | B5-7:0 |

Fig.4-2-4 eDP 2lane 8bit input data mapping



5. Electrical Characteristics

5-1. Absolute Maximum Ratings

| Parameter | Symbol | Condition | Ratings | | Unit | Remark |
|---------------------------|--------|-----------|---------|---------|------|------------|
| | | | Min. | Max. | | |
| +3.3V supply voltage | VDD | Ta=25°C | -0.3 | +4.0 | V | |
| Back Light supply voltage | VBL | Ta=25°C | -0.3 | +10.5 | V | |
| Input voltage(eDP) | VI | Ta=25°C | -0.3 | +1.5 | V | [Note 5-1] |
| Input voltage(BL) | VBL_I | Ta=25°C | -0.3 | VDD+0.3 | V | [Note 5-2] |
| Operation temperature | TOPR | - | 0 | +50 | °C | [Note 5-3] |
| Storage temperature | TSTG | - | -20 | +60 | °C | |

(*) “Absolute Maximum Ratings” is regulations that do not exceed it even momentarily.

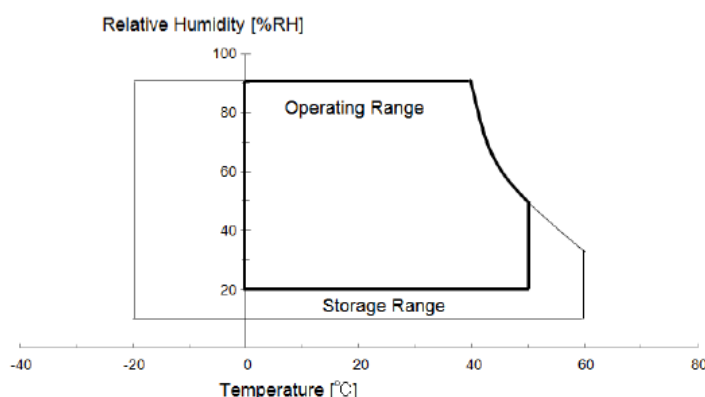
(*) Stress beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.

[Note 5-1] eDP signal

[Note 5-2] Backlight control signals (BL_ENABLE, BL_PWM_DIM)

[Note 5-3] Humidity: 90% RH Max. (Ta ≦ +40°C).

Maximum wet-bulb temperature at +39°C or less at Ta > +40°C, No condensation.



5-2. DC Characteristics

5-2-1. TFT-LCD panel driving

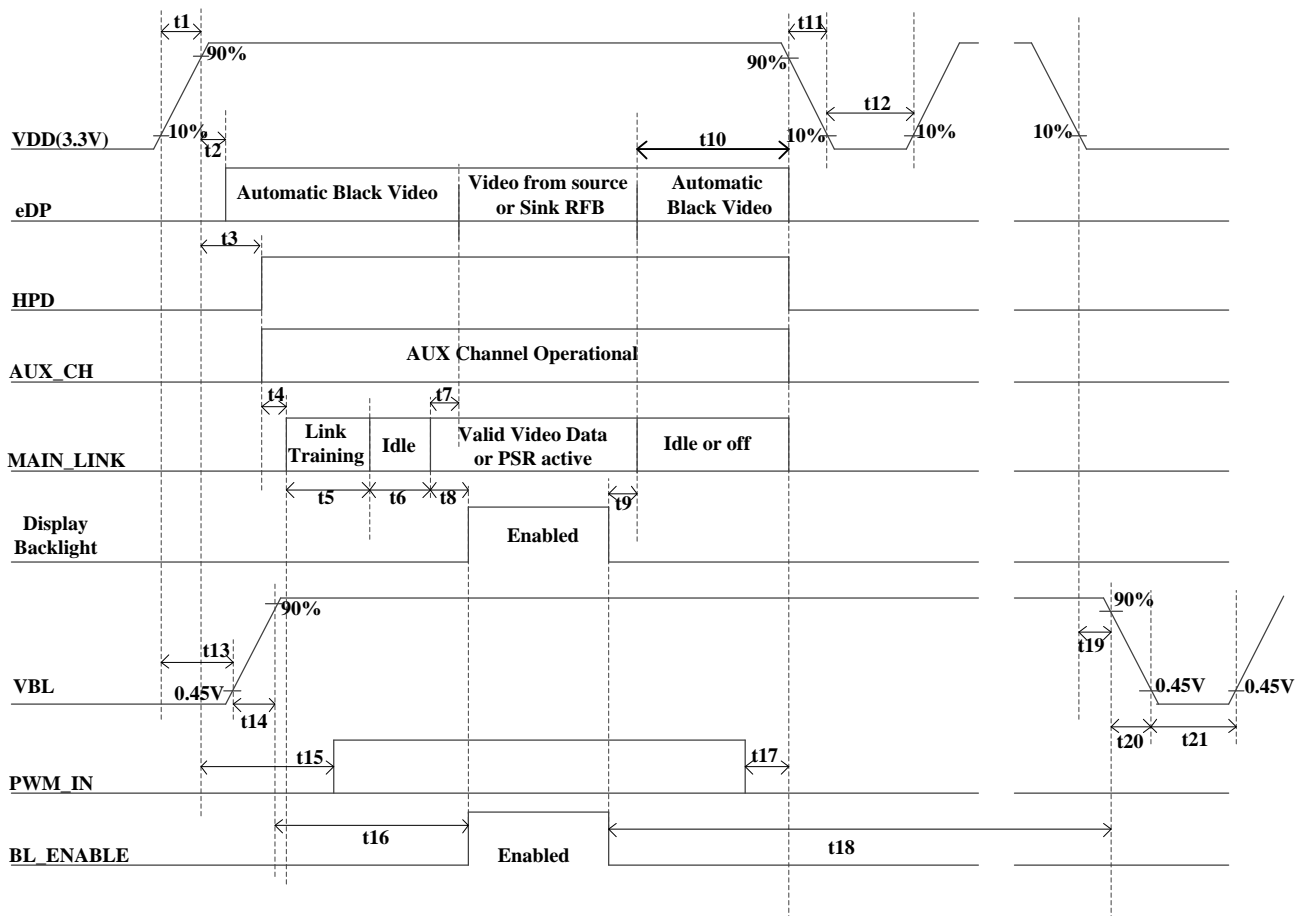
Ta = +25°C

| DC Electrical Characteristics | | | | | | |
|--|--------------------------|------|------|------|-------|--------------------|
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
| +3.3V supply voltage | VDD | +3.0 | +3.3 | +3.6 | V | [Note 5-2-1] |
| Current dissipation | IDD | - | TBD | | mA | [Note 5-2-2] |
| Permissible input ripple voltage | V _{RP} | - | - | 100 | mVp-p | VDD = +3.3V |
| eDP AUX Channel Characteristics | | | | | | |
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
| Unit Interval for AUX channel | UI _{AUX} | 0.4 | 0.5 | 0.6 | μS | |
| Peak-to-peak voltage at TP1 | V _{AUX-DIFF-pp} | 0.32 | - | 1.36 | V | |
| AUX DC Common mode Voltage | V _{AUX-DC-CM} | 0 | - | 2.0 | V | |
| AUX Short current limit | I _{AUX_SHORT} | - | - | 90 | mA | |
| AUX CH termination DC resistor | R _{AUX_TERM} | - | 100 | - | Ω | Differential input |
| AUX AC coupling capacitor | C _{AUX} | 75 | - | 200 | nF | |
| Number of pre-charge pulses | Pre-charge pulses | 10 | - | 16 | | |
| eDP Main Link Receiver Characteristics | | | | | | |
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |



| | | | | | | |
|--|--|----|-----|------|----------|--|
| Link clock down spreading | Down_Spread_Amplitude | 0 | | 0.5 | % | |
| Differential Peak-to-peak Input Voltage at Rx package pins | $V_{RX-DIFFP-P}$ | 90 | - | 1200 | mV | |
| Differential Return Loss at 1.35GHz at Rx package pins | $RL_{RX-DIFF}$ | 9 | - | - | dB | |
| Differential termination resistance | $R_{RX-TERM}$ | - | 100 | - | Ω | |
| RX short circuit Current Limit | $I_{RX-SHORT}$ | - | - | 50 | mA | |
| Lane Intra-pair Skew at RX package pins | $T_{RX-SKEW-INTRA-P}$ AIR-High-Bit-Rate | - | - | 50 | ps | |

[Note 5-2-1] ON-OFF conditions for supply voltage



[Note5-2-1] Do not keep the interface signal high-impedance or unusual signal when power is on.

| Symbol | Min | Max | Unit | Note |
|--------|-----|-----|------|------|
| t1 | 0.5 | 10 | ms | |
| t2 | 0 | 200 | ms | |
| t3 | 0 | 100 | ms | |
| t4 | - | - | ms | |
| t5 | - | - | ms | |
| t6 | - | - | ms | |
| t7 | 0 | 50 | ms | |
| t8 | - | - | ms | |
| t9 | - | - | ms | |



| | | | | |
|-----|-----|-----|----|--------------|
| t10 | 0 | 500 | ms | |
| t11 | 1 | 50 | ms | [Note 5-2-3] |
| t12 | 500 | - | ms | |
| t13 | - | - | ms | |
| t14 | 0.5 | 10 | ms | |
| t15 | 100 | - | ms | |
| t16 | 0 | - | ms | |
| t17 | 0 | - | ms | |
| t18 | - | - | ms | |
| t19 | - | - | ms | |
| t20 | 0.1 | - | ms | |
| t21 | 100 | - | ms | |

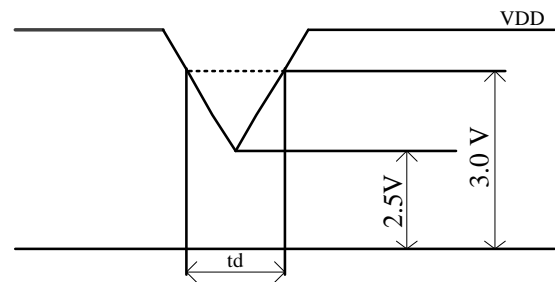
[Note 5-2-3]As for the power off sequence for VDD (t11), be sure to keep above mentioned timing.
 If the VDD power off sequence timing is other than shown above, LCD may cause permanent damage.
 *1 : As for the power sequence for backlight, it is recommended to apply above mentioned input timing.
 If the backlight is light on and off at a timing other than shown above, displaying image maybe get disturbed.

VDD-dip-conditions

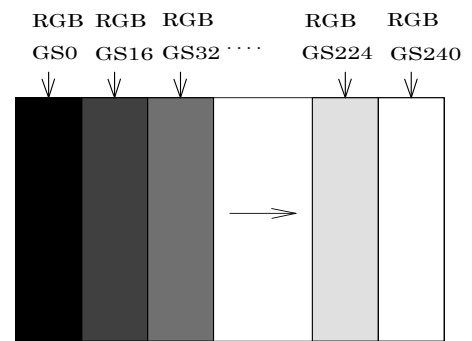
- 1) $2.5\text{ V} \leq \text{VDD} < 3.0\text{ V}$
 $t_d \leq 10\text{ ms}$

Under above condition, the display image should return to appropriate figure after VDD voltage recovers.

- 2) $\text{VDD} < 2.5\text{ V}$
 VDD-dip conditions should also follow the ON-OFF conditions for supply voltage.



[Note 5-2-2]
 Typical current condition: 16-gray-bar pattern.
 $\text{VDD} = +3.3\text{ V}$



Maximum current condition: Vertical stripe pattern.
 $\text{VDD} = +3.3\text{ V}$





5-3. Backlight driving

The backlight system is an edge-lighting type with white-LED.

(It is usually required to measure under the following condition: $T_a=25^{\circ}\text{C} \pm 2^{\circ}\text{C}$)

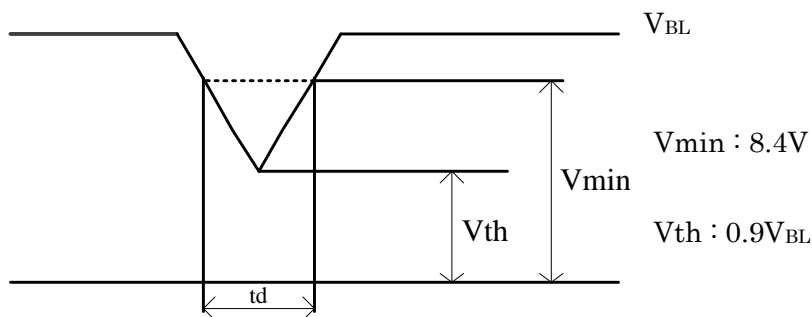
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|------------------------------------|------------|------|-------|--------------------|---------------|--------------------------|
| Supply voltage | V_{BL} | 8.4 | 9.3 | 10.5 | V | |
| Current dissipation | I_{BL} | - | 680 | 1020 | mA | |
| Modulated light signal voltage | V_{PWMH} | 1.85 | - | VDD | V | |
| | V_{PWL} | 0 | - | 0.7 | V | |
| Brightness Control Duty Ratio | Duty | 1 | - | 100 | % | 【Note5-3-1】 |
| Brightness Control pulse width | T_{PWM} | 5 | - | - | us | 【Note5-3-2】 |
| Brightness Control frequency | f_{PWM} | 200 | - | 2000 | Hz | |
| LED-BL ON/OFF High voltage | V_{CNTH} | 1.3 | - | VDD | V | 【Note5-3-3】 |
| LED-BL ON/OFF Low voltage | V_{CNTL} | 0 | - | 0.5 | V | |
| Input signal (H level) pin current | I_{IN} | - | - | $V_{IN}/56K\Omega$ | μA | BL_ENABLE, BL_PWM_DIM |
| LED lifetime | - | - | 30000 | - | h | LED |

【Note5-3-1】 V_{PWM} Input : 100% = Max luminance 1% = Min luminance

【Note5-3-2】 The minimum value of the dimming signal pulse width is assumed regulations of the width of high and the width of low.

【Note5-3-3】 V_{CNT} Input : High = BL turn on, Low or OPEN = BL turn off

VBL-dip conditions



$$1) V_{th} \leq V_{BL} < V_{min} : t_d \leq 20\text{ms}$$

2) $V_{BL} < V_{th}$: The condition of instantaneous voltage drop is apply to input voltage sequences

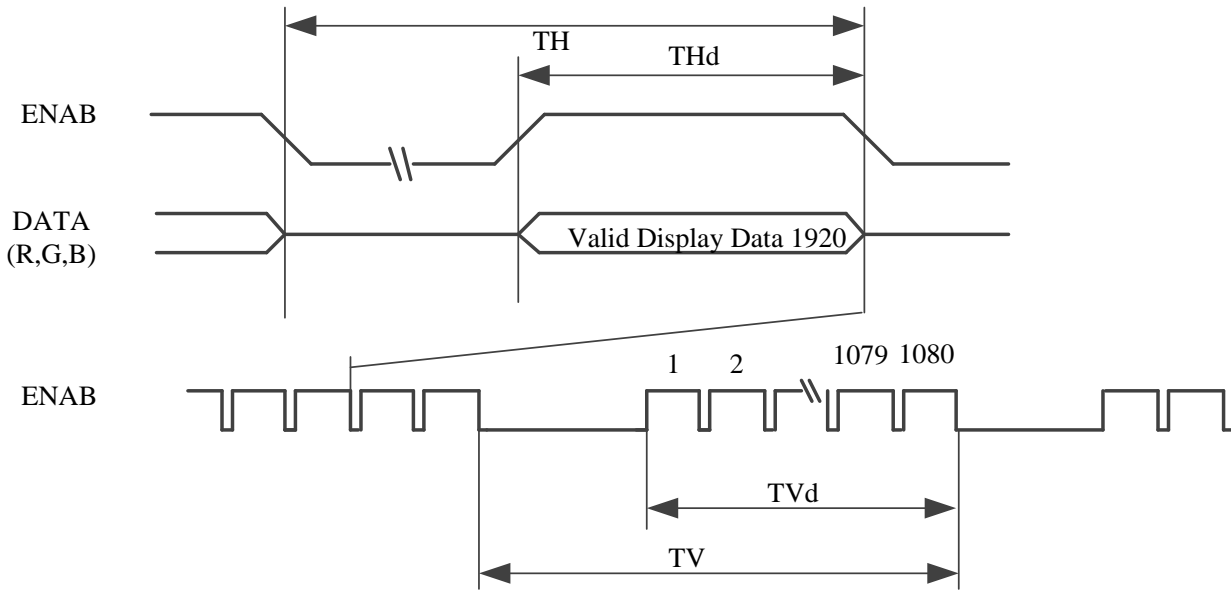


6. Timing characteristics of input signals

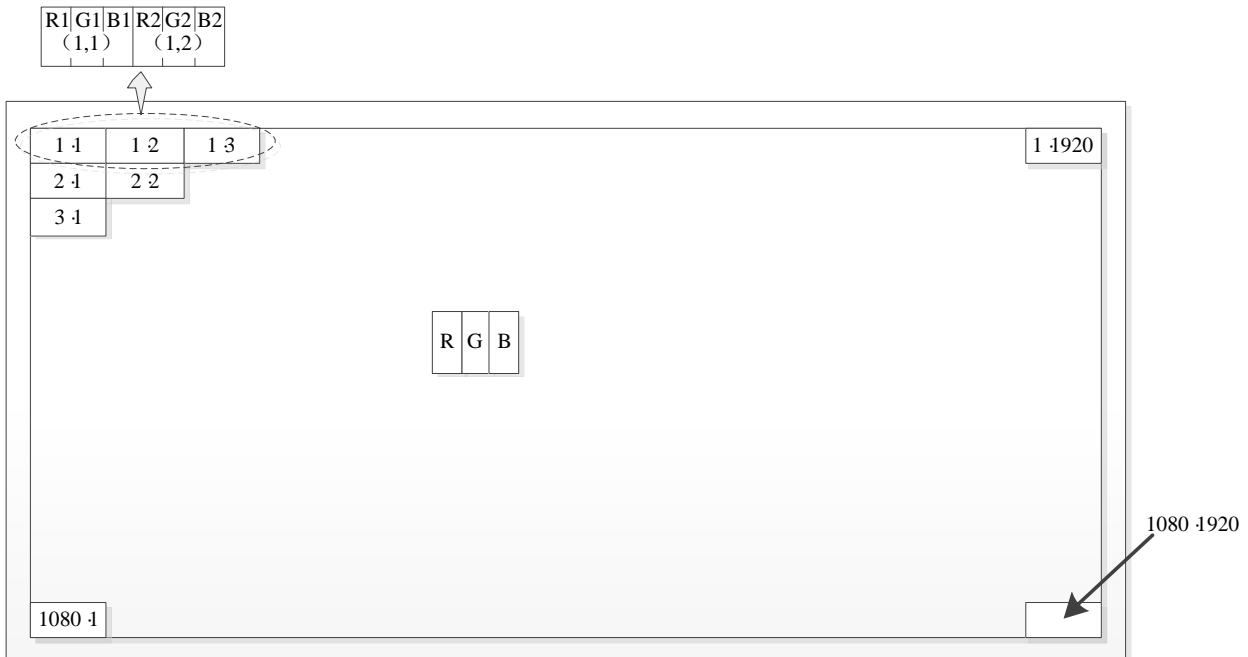
6-1. Timing Characteristics

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--------------------|--------------------------|------------------|-------|--------|-------|-------|--------------|
| Clock | Frequency | 1/T _C | 132.0 | 138.5 | 140.0 | MHz | [Note 6-1-1] |
| Data enable signal | Horizontal period | TH | 2020 | 2080 | 2400 | clock | |
| | Horizontal period (High) | THd | - | 15.02 | - | μs | |
| | Vertical period | TV | 1090 | 1111 | 1200 | line | |
| | Vertical period (High) | TVd | - | 16.685 | - | ms | |
| | Vertical period (High) | TVd | - | 1080 | - | line | |

[Note 6-1-1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.



6-2. Input data signals and display position on the screen



Display position of input data(V H)



7. Input signal, basic display colors and gray scale of each color

| Colors & Gray Scale | Gray Scale | Data signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|------------|-------------|----|----|----|----|----|----|----|-----|----|----|----|----|----|----|----|-----|----|----|----|----|----|----|----|-----|--|--|--|--|--|
| | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | | | | | | |
| | | LSB | | | | | | | | MSB | | | | | | | | LSB | | | | | | | | MSB | | | | | |
| Basic Color | 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 | | | | | |
| | Blue | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| | Green | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| | Cyan | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| | Red | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| | Magenta | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| | Yellow | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 Scale of Red | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↑ | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | Darker | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↑ | ↓ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | | | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | | | | | | |
| | Brighter | GS253 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↓ | GS254 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | Red | GS255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| Gray Scale of Green | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | |
| | ↑ | ↓ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | | | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | | | | | | |
| | Brighter | GS253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↓ | GS254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | Green | GS255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| Gray Scale of Blue | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| | ↑ | ↓ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | | | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | ↓ | | | | | | | | ↓ | | | | | | | | | | | | |
| | Brighter | GS253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | |
| | ↓ | GS254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | |
| | Blue | GS255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | |

0: Low level voltage, 1: High level voltage.

Each basic color can be displayed in 256 gray scales from 8 bit data signals.

According to the combination of 24 bit data signals, the 16.7M color display can be achieved on the screen.



8. EDID Specifications (TBD)



9. Optical characteristics

Ta=25°C

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark | | |
|-----------------------|------------|--------------------------------|-----------|-------|-------|-------|------|---|-------------------|--|
| Viewing angle range | Horizontal | θ21 θ22 | CR>10 | 80 | 89 | - | Deg. | [Note9-1,9-3,9-4,9-6] | | |
| | Vertical | θ11 | | 80 | 89 | - | Deg. | | | |
| | | θ12 | | 80 | 89 | - | Deg. | | | |
| Contrast ratio | | CR | | 700 | 1000 | - | - | [Note9-2,9-4,9-6] | | |
| Response time | | τ _r +τ _d | | - | 25 | - | ms | [Note9-1,9-5,9-6] | | |
| Chromaticity of white | | x | θ=0 deg. | 0.283 | 0.313 | 0.343 | - | [Note 9-2, 9-6] Normal operation (PWM Duty=100%) | | |
| | | y | | 0.299 | 0.329 | 0.359 | - | | | |
| Chromaticity of red | | x | | - | TBD | - | - | | | |
| | | y | | - | TBD | - | - | | | |
| Chromaticity of green | | x | | - | TBD | - | - | | | |
| | | y | | - | TBD | - | - | | | |
| Chromaticity of blue | | x | | - | TBD | - | - | | | |
| | | y | | - | TBD | - | - | | | |
| NTSC ratio | | % | | | - | 72 | - | | - | |
| Luminance of white | | Y _{LI} | | | - | 500 | - | | cd/m ² | |
| White uniformity 13pt | | δ _w | θ=0 deg. | - | 1.3 | 1.5 | - | [Note 9-2, 9-7] | | |

※The measurement shall be taken 30 minutes after lighting the module at the following rating.

Condition: PWM Duty = 100%

The optical characteristics shall be measured in a dark room or equivalent.

[Note 9-1] Measurement of viewing angle range [Note 9-2] Measurement of luminance and Response time. Chromaticity and Contrast.

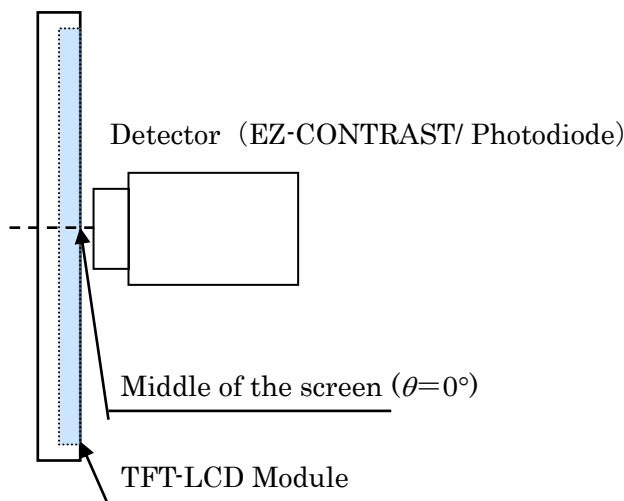


Fig.9-1 Measurement of Viewing angle range and Response time.
(Viewing angle range: EZ-CONTRAST, Response time: Photodiode)

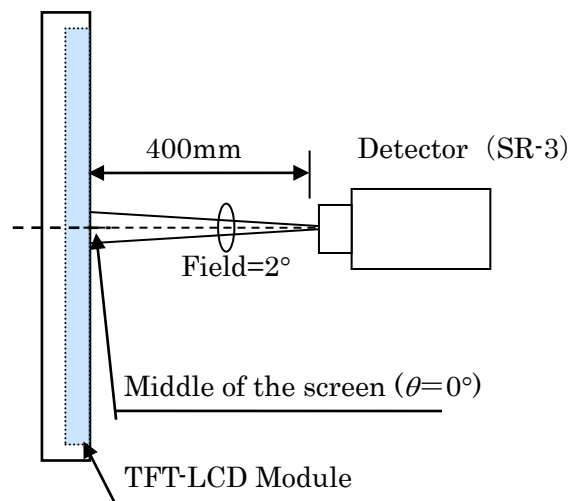


Fig.9-2 Measurement of Contrast, Luminance, Chromaticity, White variation, Crosstalk and Color temperature variation.



[Note 9-3]Definitions of viewing angle range:

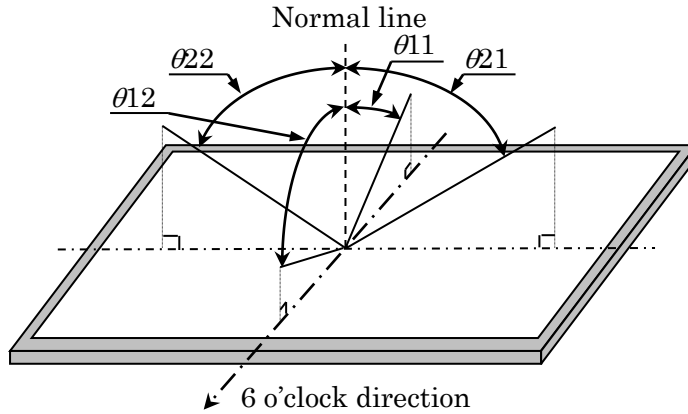


Fig.9-3 Viewing angle

[Note 9-4]Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance(Brightness) with all pixels white}}{\text{Luminance(Brightness) with all pixels Black}}$$

[Note 9-5]Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

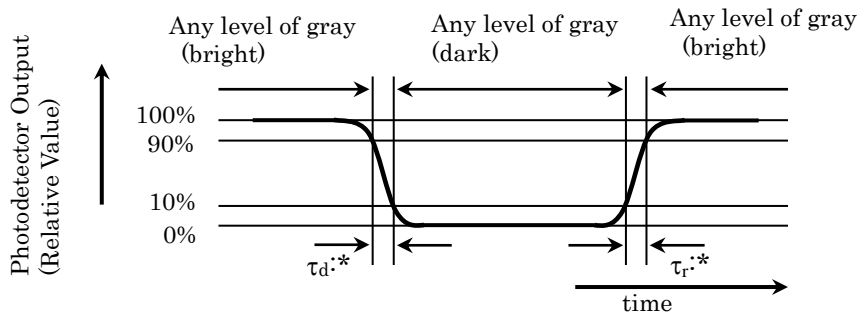


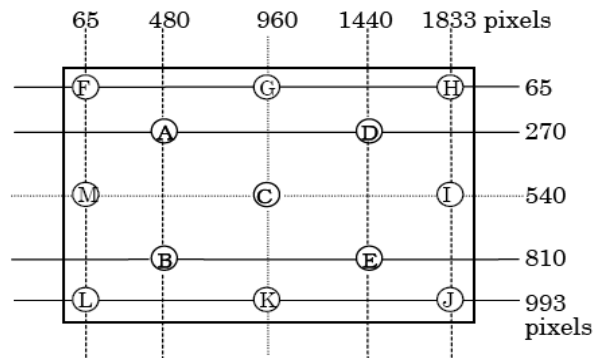
Fig.9-4 Response time

[Note 9-6] This shall be measured at center of the screen.

[Note 9-7]Definition of white uniformity:

White uniformity is defined as the following with 13 measurements(A~M).

$$\delta_w = \frac{\text{Maximum Luminance of 13 Points(Brightness)}}{\text{Minimum Luminance of 13 Points(Brightness)}}$$





10. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

11. Handling Precautions

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
Please insert for too much stress not to join a connector in the case of insertion of a connector.
- b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- c) Since the front polarizer is easily damaged, pay attention not to scratch it.
- d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.
- h) This module has its circuitry PCBs on the side and should be handled carefully in order not to be stressed.
- i) Laminate film is attached to the module surface to prevent it from being scratched. Peel the laminate film off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc. Working under the following environments is desirable.
 - All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.
 - Use Ionized blower for electrostatic removal, and peel of the laminate film with a constant speed. (Peeling of it at over 2 seconds)
- j) The polarizer surface on the panel is treated with Anti-Glare. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
- k) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.
- l) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
- m) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
- n) Disassembling the module can cause permanent damage and should be strictly avoided. Please don't remove the fixed tape, insulating tape etc that was pasted on the original module. (Except for protection film of the panel.)
- o) Be careful when using it for long time with fixed pattern display as it may cause afterimage. (Please use a screen saver etc., in order to avoid an afterimage.)
- p) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
- q) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series), tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardless of contact or noncontact to polarizer film. Be sure to confirm the component of them.
- r) Do not use polychloroprene. If you use it, there is some possibility of generating Cl₂ gas that influences the reliability of the connection between LCD panel and driver IC.
- s) Do not put a laminate film on LCD module, after peeling of the original one. If you put on it, it may cause discoloration or spots because of the occurrence of air gaps between the polarizer and the film.
- t) Ground module bezel to stabilize against EMI and external noise.



12. Packaging Condition(TBD)

13. Label (TBD)

14. RoHS Directive

This LCD module is compliant with RoHS Directive.

15. Reliability Test Items(TBD)

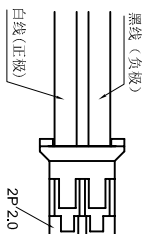
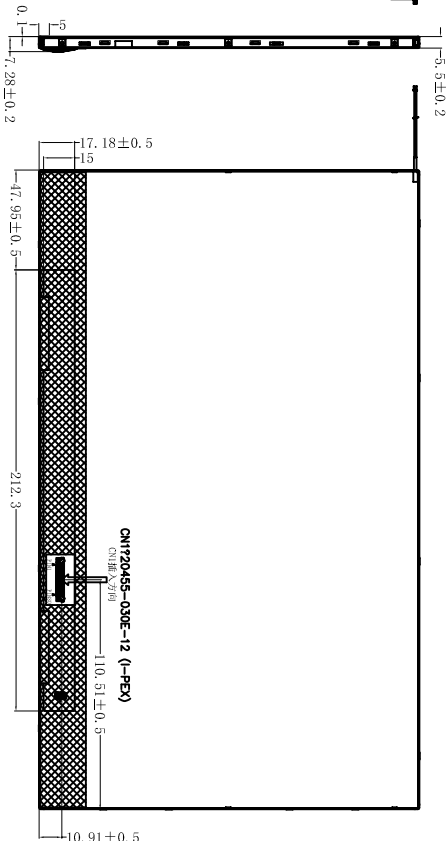
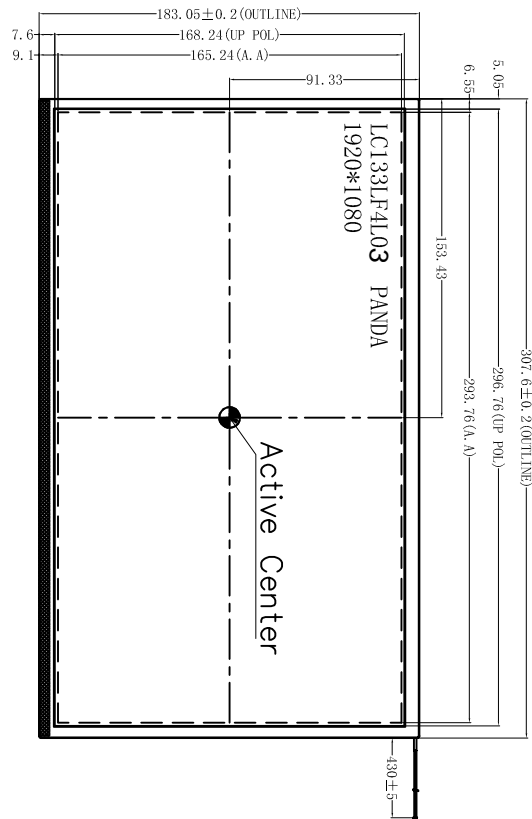
Kingtech Group Co., Ltd.

Date: 2016.02.23 Page: 1/1 THE THIRD ANGLE

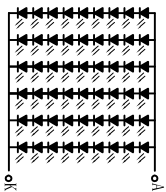
Customer Code.: CUSTOMER'S P/N:
FX'S P/N(exclude wrapper):

PV013305KSG30F

| | |
|----------------------------|-------------|
| SPECIFICATION OF BACKLIGHT | EDITION: 01 |
| FX'S P/N:(include wrapper) | |
| Approval(核准) | |
| Check (检查) | |
| Design(设计) | |



- Notes:
- Unit:mm.
 - Do not scale drawing.
 - All radii without dimension R0.2.
 - Modification Mark.
 - draft angle: 1°
 - Luminance uniformity: 75%(min)(min/max*100%)
 - Backlight luminance : 模组500cd/m²(TYP)
 - Unspecified Tolerance is ±0.2
 - Operation conditions : If= 240mA(TYP) 360mA(MAX), Vf=27-32.4V(MAX)
 - Color coordinate: X=0.27-0.35, Y=0.27-0.35(模组)
 - All materials comply with RoHS
 - The measured value of luminance and color coordinate bases FX's BM-7
 - Check item: 1~9



| REV | DATE | DESCRIPTION (修改内容) | REVISER/NO. | APPROVE BY: | APPROVAL DATE: |
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| REV | DATE | DESCRIPTION (修改内容) | REVISER/NO. | APPROVE BY: | APPROVAL DATE: |
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