**Doc. Number:**

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

# MODEL NO.: LSA40AT9001

**Customer**:

**APPROVED BY** **SIGNATURE**

**Name / Title** _____ _____
Note

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

| Approved By | Checked By | Prepared By |
|---|---|---|
| KJ Cheng | Jessie Chu | Tingyu Fang |



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**REVISION HISTORY**

| Version | Date | Page (New) | Section | Description |
|---|---|---|---|---|
| Ver 0.0 | 2010/8/6 | All | All | Product spec was first issued. |



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## 1.PURPOSE

LSA40AT9001 is a transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This panel has a 10.4 inches diagonally measured active display area with SVGA (800 RGB x 600) resolution. The following describes the features of this product.

## 2. FEATURES

- 10.4" (diagonal) inch configuration
- SVGA (800x600 pixels) resolution

## 3.GENERAL RULES OF SINGLE PANEL

| No. | Item | Specification | Unit |
|---|---|---|---|
| 1 | Screen Size | 10.4 (Diagonal) | inch |
| 2 | Display Resolution | 800 RGB x 600 | pixel |
| 3 | Dot Pitch | 0.088 (H) x 0.264 (V) | mm |
| 4 | Pixel Pitch | 0.264 (H) x0.264 (V) | mm |
| 5 | Active Area | 211.2(H) x 158.4(V) | mm |
| 6 | Outline Dimension | 228.4 (H) x 175.4 (V) x 5.9 (D) | mm |
| 7 | Pixel Configuration | RGB-Stripe | -- |
| 8 | Color Depth | 16.2M | colors |
| 9 | LCD Type | TM TN | -- |
| 10 | Interface Type | Digital 24bit RGB | -- |
| 11 | Surface Treatment | 3H | -- |
| 12 | View direction (Gray inversion) | 6 o'clock | -- |
| 13 | Weight | 390 | g |

## 4. ABSOLUTE MAXIMUM RATING

(Ta = 25 ± 2℃)

| Item | Symbol | Values | | Unit | Note |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -20 | 60 | ℃ | |
| Operation Temperature | $T_{OP}$ | -10 | 50 | ℃ | |
| Digital Supply Voltage | VCC | -0.3 | 5 | V | (2) |
| Analog Power Supply Voltage | AVDD | -0.5 | 15 | V | (3) |
| TFT Device on voltage | $V_{GH}$ | -0.3 | 42 | V | (4) |
| TFT Device off voltage | $V_{GL}$ | $V_{GH}$ - 42 | 0.3 | V | (4) |

Note:

(1) All of the voltages listed above are with respective to GND= 0V

(2) Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.



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## 5. ELECTRICAL CHARICTERISTICS

### 5-1. Operating Conditions:

(Ta = 25 ± 2℃)

| Item | Symbol | Values | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Digital Power Supply Voltage | VCC | 3.0 | 3.3 | 3.6 | V | |
| Digital Supply Current | $I_{CC}$ | 24 | 30 | 45 | mA | Black Pattern |
| Analog Power Supply Voltage | AVDD | 10.3 | 10.5 | 10.7 | V | |
| Analog Supply Current | $I_{AVDD}$ | 32 | 40 | 60 | mA | Black Pattern |
| TFT Device on voltage | $V_{GH}$ | - | 18 | - | V | |
| TFT Device off voltage | $V_{GL}$ | - | -7 | - | V | |
| Common Electrode Driving Voltage | VCOM | - | 4.45 | - | V | |
| LED Reverse Voltage | Vr | | | 1.5 | V | For single LED |
| LED Forward Current | If | | 20 | 30 | mA | For single LED |

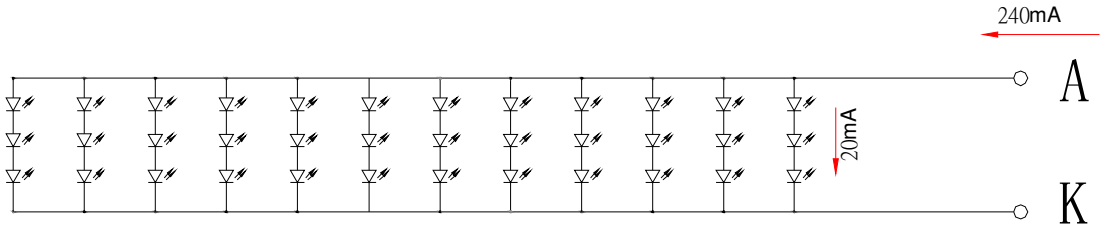
### 5-2. Backlight Driving Conditions:

(Ta = 25 ± 2℃)

| Item | Symbol | Values | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Power Consumption | $P_{BL}$ | -- | 2.304 | 2.52 | W | -- |
| LED Current | $I_F$ | -- | 240 | -- | mA | -- |
| Backlight Voltage | $V_{BL}$ | -- | 9.6 | 10.5 | V | -- |
| Life Time | -- | 10000 | -- | -- | **hrs** | (1) |

Note:

(1) Brightess to be decreased to 50% of the initial value



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## 6. DC CHARCTERISTICS

### 6.1 Parameter

(Ta = 25 ± 2℃)

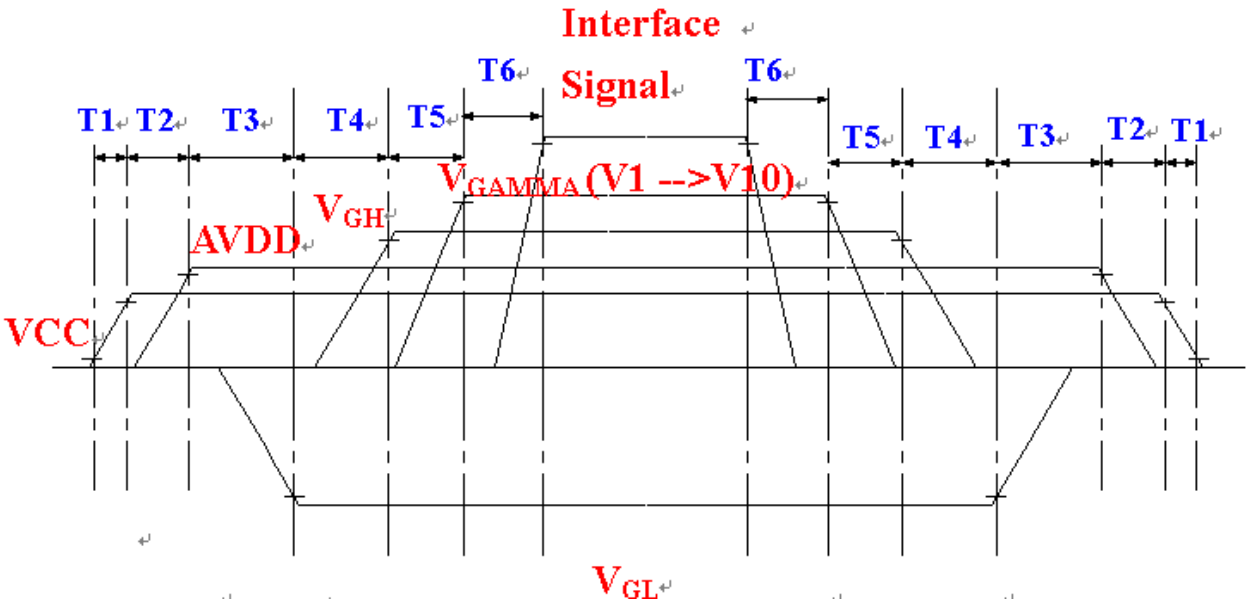
| Item | Symbol | Values | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Low Level Input Voltage | $V_{IL}$ | 0 | - | 0.3VCC | V | (1) |
| High Level Input Voltage | $V_{IH}$ | 0.7 VCC | - | VCC | V | (1) |

Note:

(1) For Digital Circuit

### 6.2 Power Sequence

The LCD panel power ON/OFF sequence is as below




| | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| T1 | - | - | 20 | ms |
| T2 | 16 | - | - | ms |
| T3 | > 0 | | | ms |
| T4 | >0 | | | ms |
| T5 | >0 | | | ms |
| T6 | >0 | | | ms |



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## 7. AC CHARCTERISTICS

7.1. Data Timing (Under frame rate is equal to 60Hz)

Horizontal Timing

| Parameter | Symbol | Spec | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Horizontal Display Area | thd | | 800 | | CLK |
| CLK Frequency | fclk | - | 40 | 50 | MHz |
| One Horizontal Line | th | 862 | 1056 | 1200 | CLK |
| HS Pulse Width | thpw | 1 | - | 40 | CLK |
| HS Back Porch | thb | | 46 | | CLK |
| HS Front Porch | thfp | 16 | 210 | 354 | CLK |

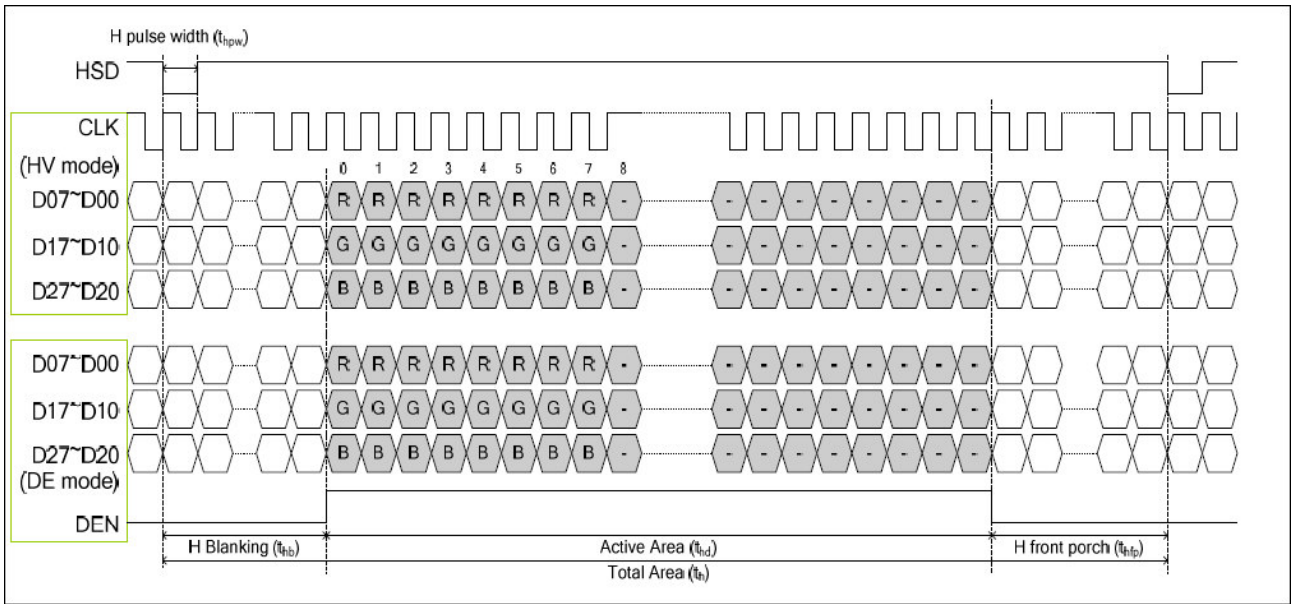
Vertical Timing

| Parameter | Symbol | Spec | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Vertical Display Area | tvd | | 600 | | th |
| VS Period Time | tv | 624 | 635 | 700 | th |
| VS Pulse Width | tvpw | 1 | - | 20 | th |
| VS Back Porch | tvb | 23 | 23 | 23 | th |
| VS Front Porch | tvfp | 1 | 12 | 77 | th |

Note:

CMO suggest using frame rate 60Hz to have better performance

Horizontal Timing



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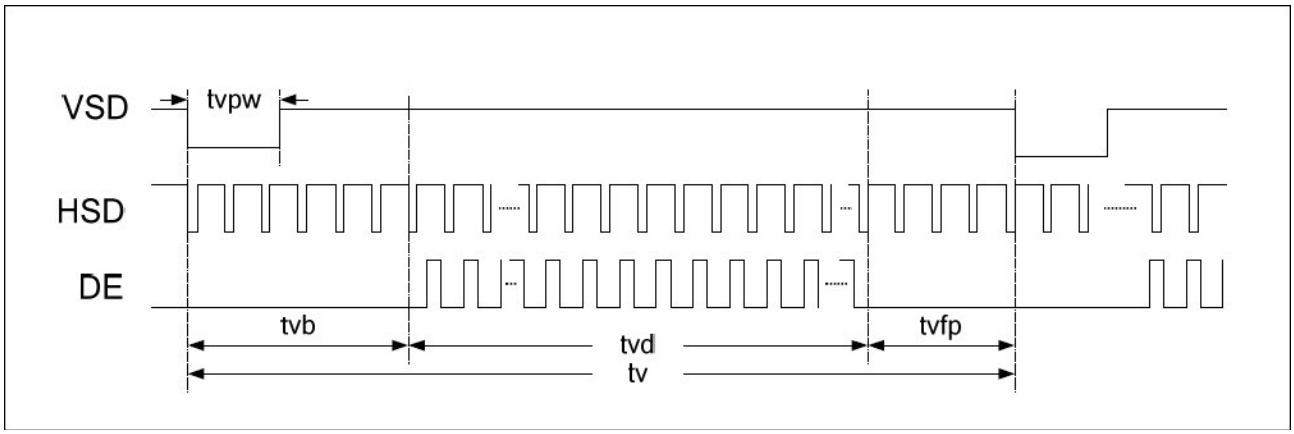
Vertical Timing




7.2. AC Electrical characteristic

| Parameter | Symbol | Spec. | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| HS setup time | $T_{hst}$ | 8 | - | - | ns |
| HS hold time | $T_{hhd}$ | 8 | - | - | ns |
| VS setup time | $T_{vst}$ | 8 | - | - | ns |
| VS hold time | $T_{vhd}$ | 8 | - | - | ns |
| Data setup time | $T_{dsu}$ | 8 | - | - | ns |
| Data hold time | $T_{dhd}$ | 8 | - | - | ns |
| DE setup time | $T_{esu}$ | 8 | - | - | ns |
| DE hold time | $T_{ehd}$ | 8 | - | - | ns |
| VDD Power On Slew Rate | $T_{POR}$ | - | - | 20 | ms |
| RSTB pulse width | $T_{Rst}$ | 10 | - | - | us |
| CLKIN cycle time | $T_{cph}$ | 20 | - | - | ns |
| CLKIN pulse duty | $T_{cwh}$ | 40 | 50 | 60 | % |
| Output stable time | $T_{sst}$ | - | - | 6 | ns |
| Repair OPA Output Stable time | $T_{Rsst}$ | - | - | 6 | ns |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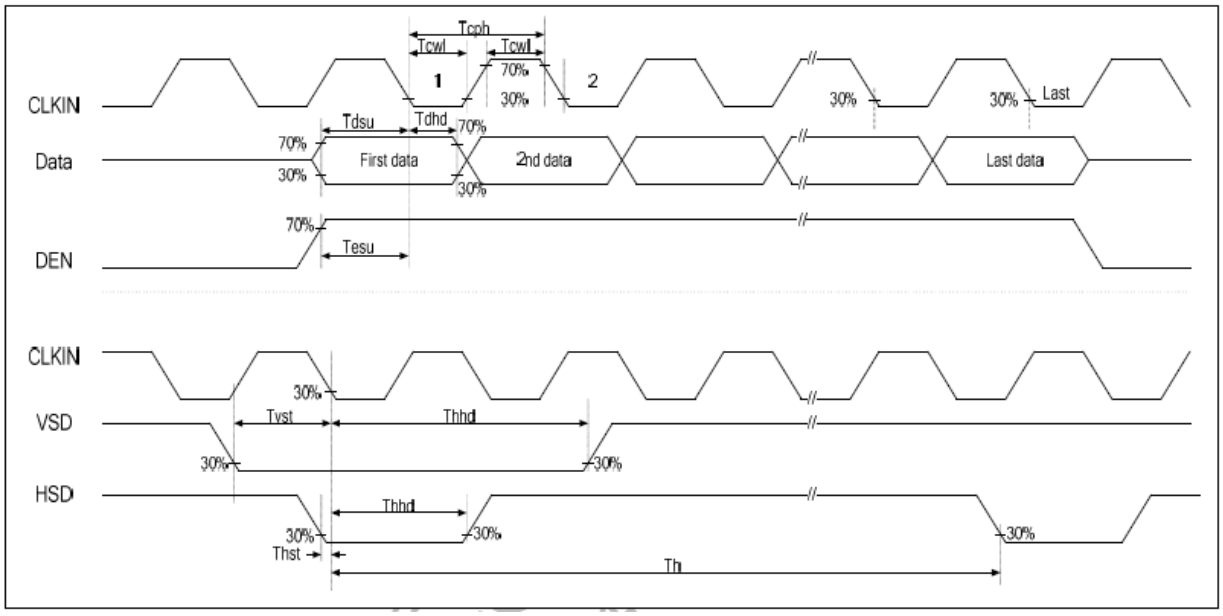
7.3. Input Clock and Data Timing Waveform



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## 8. OPTICAL CHARCTERISTICS

(Ta = 25 ± 2℃, $I_F$=20mA)

| Item | | Symbol | Conditions | Specifications | | | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | | |
| Contrast Ratio | | CR | Viewing normal angle θ= 0° Φ= 0° B/L On | 300 | 500 | -- | -- | (2),(4),(6) |
| Brightness | | B | | 200 | 250 | -- | cd/m$^2$ | |
| Response time | | $T_r$ | | -- | 5 | 10 | ms | (3) |
| | | $T_f$ | | -- | 15 | 20 | ms | |
| Chromaticity | Red | Rx | | 0.523 | 0.573 | 0.623 | -- | (2)(5)(6) |
| | | Ry | | 0.30 | 0.350 | 0.40 | -- | |
| | Green | Gx | | 0.286 | 0.336 | 0.386 | -- | |
| | | Gy | | 0.547 | 0.597 | 0.647 | -- | |
| | Blue | Bx | | 0.102 | 0.152 | 0.202 | -- | |
| | | By | | 0.062 | 0.112 | 0.162 | -- | |
| | White | Wx | | 0.26 | 0.31 | 0.36 | -- | |
| | | Wy | | 0.28 | 0.33 | 0.38 | -- | |
| Viewing Angle | Hor. | $\theta_L$ | CR≧10 B/L On | 60 | 70 | - | deg. | (1) |
| | | $\theta_R$ | | 60 | 70 | - | | |
| | Ver. | $\Phi_T$ | | 40 | 50 | - | | |
| | | $\Phi_B$ | | 50 | 60 | - | | |
| NTSC | | -- | -- | -- | 50 | -- | % | |
| Uniformity | | -- | -- | -- | 80 | -- | % | (7) |

Note:

(1) Definition of viewing angle range

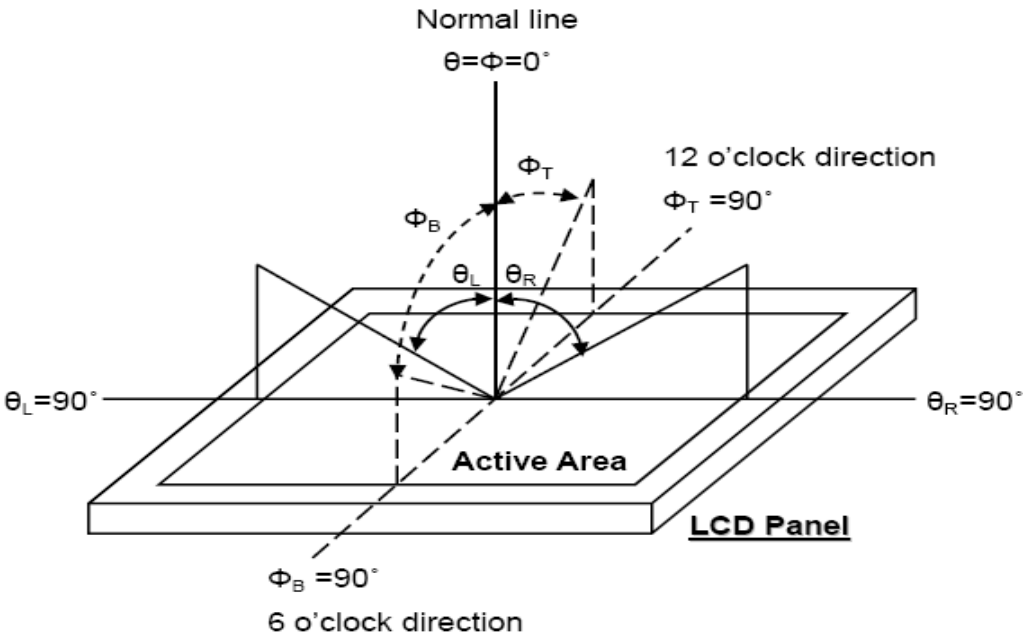


Fig. 8-1 Definition of viewing angle



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(2) Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

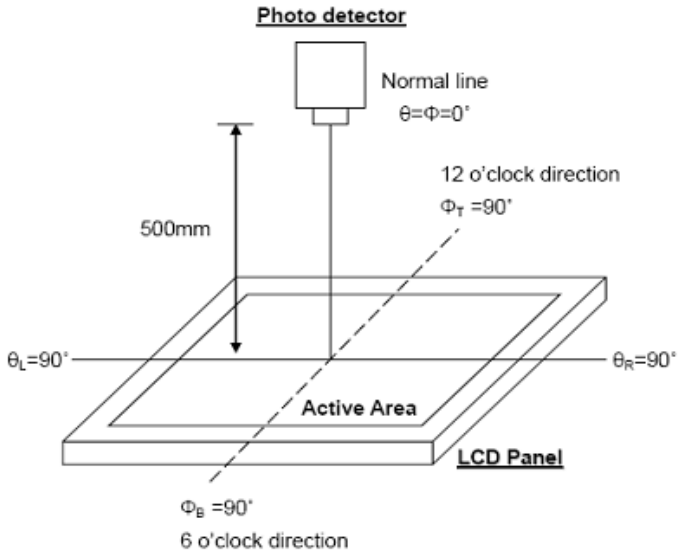


Fig. 8-2 Optical measurement system setup

(3) Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state And “Black” state. Rise time, Tr, is the time between photo detector output intensity changed from 90% to 10%. And fall time, Tf, is the time between photo detector output intensity changed from10% to 90%.

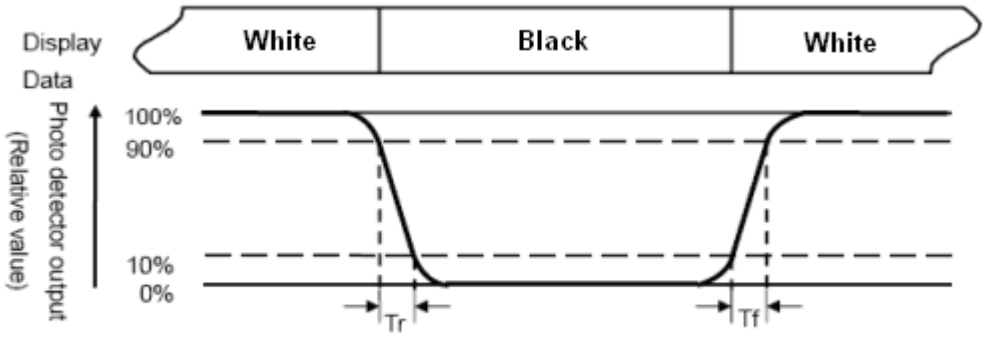


**Fig. 8-3 Definition of response time**



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(4) Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the “White” state}}{\text{Luminance measured when LCD on the “Black” state}}$$

(5) Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

(6) Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

$$\text{(7) Uniformity (U)} = \frac{\text{Brightness (min)}}{\text{Brightness (max)}} \times 100\%$$



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**9. INTERFACE PIN CONNECTION**

| Pin | Symbol | I/O | Function | **Remark** |
|---|---|---|---|---|
| 1 | GND | G | Power Ground | |
| 2 | AVDD | P | Analog input voltage | |
| 3 | VCC | P | Digital input voltage | |
| 4 | R0 | I | Red data input (LSB) | |
| 5 | R1 | I | Red data input | |
| 6 | R2 | I | Red data input | |
| 7 | R3 | I | Red data input | |
| 8 | R4 | I | Red data input | |
| 9 | R5 | I | Red data input | |
| 10 | R6 | I | Red data input | |
| 11 | R7 | I | Red data input (MSB) | |
| 12 | G0 | I | Green data input (LSB) | |
| 13 | G1 | I | Green data input | |
| 14 | G2 | I | Green data input | |
| 15 | G3 | I | Green data input | |
| 16 | G4 | I | Green data input | |
| 17 | G5 | I | Green data input | |
| 18 | G6 | I | Green data input | |
| 19 | G7 | I | Green data input (MSB) | |
| 20 | B0 | I | Blue data input (LSB) | |
| 21 | B1 | I | Blue data input | |
| 22 | B2 | I | Blue data input | |
| 23 | B3 | I | Blue data input | |
| 24 | B4 | I | Blue data input | |
| 25 | B5 | I | Blue data input | |
| 26 | B6 | I | Blue data input | |
| 27 | B7 | I | Blue data input (MSB) | |
| 28 | CLKIN | I | Dot clock input | |
| 29 | DEN | I | Data enable signal | |
| 30 | HSD | I | HSYNC signal | |
| 31 | VSD | I | VSYNC signal | |



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| | | | | |
|---|---|---|---|---|
| 32 | MODE | I | H: DE mode (Default)<br>L: SYNC mode | |
| 33 | NC | I | No connect (please leave it open) | |
| 34 | NC | I | No connect (please leave it open) | |
| 35 | NC | - | No connect (please leave it open) | |
| 36 | VCC | P | Digital input voltage | |
| 37 | NC | - | No connect (please leave it open) | |
| 38 | GND | G | Power Ground | |
| 39 | GND | G | Power Ground | |
| 40 | AVDD | P | Analog input voltage | |
| 41 | VCOM | P | VCOM DC input | |
| 42 | DITH | I | Dithering function setting<br>H: Disable dithering function<br>L: Enable dithering function | |
| 43 | NC | - | No connect (please leave it open) | |
| 44 | VCOM out | O | connect a capacitor | |
| 45 | NC | | No connect (please leave it open) | |
| 46 | NC | | No connect (please leave it open) | |
| 47 | NC | | No connect (please leave it open) | |
| 48 | NC | | No connect (please leave it open) | |
| 49 | NC | | No connect (please leave it open) | |
| 50 | NC | | No connect (please leave it open) | |
| 51 | NC | | No connect (please leave it open) | |
| 52 | NC | | No connect (please leave it open) | |
| 53 | NC | | No connect (please leave it open) | |
| 54 | NC | | No connect (please leave it open) | |
| 55 | NC | - | No connect (please leave it open) | |
| 56 | VGH | P | TFT turn on voltage | |
| 57 | VCC | P | Digital input voltage | |
| 58 | VGL | P | TFT turn off voltage | |
| 59 | GND | G | Power Ground | |
| 60 | NC | - | No connect (please leave it open) | |

Note:

(1) Suggested connector: MT-FP160N-2FR (UJU)or any equivalent



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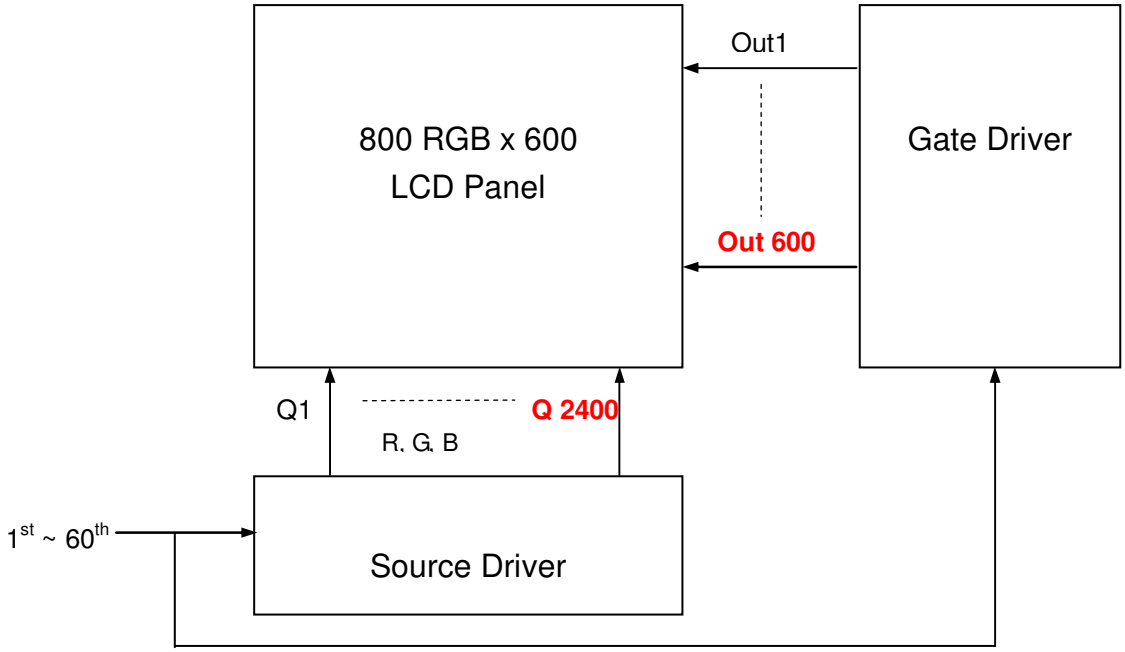
## 10. BLOCK DIAGRAM




## 11. QUALITY ASSURANCE

| No. | Test Items | Test Condition | Note |
|---|---|---|---|
| 1 | High Temperature Storage Test | Ta=60℃ Dry 240h | |
| 2 | Low Temperature Storage Test | Ta=-20℃ Dry 240h | |
| 3 | High Temperature Operation Test | Ta=50℃ Dry 240h | |
| 4 | Low Temperature Operation Test | Ta=-10℃ Dry 240h | |
| 5 | High Temperature and High Humidity Operation Test | Ta=50℃ 80%RH 240h | |
| 6 | Electro Static Discharge Test | Panel surface / top case<br>Contact / Air：±6KV / ±8KV，<br>150pF，330Ω | Non-operating |
| 7 | Shock Test (non-operating) | Shock Level : 180G<br>Waveform: Half Sinusoidal wave<br>Shock Time : 2ms<br>3 Axis for all six faces/ each | |
| 8 | Vibration Test (non-operating) | Frequency Range: 10~500Hz/<br>Sweep: 1.5G<br>Amplitude: 0.37 oct/min<br>For 3 Axis 1hrs/axis | |
| 9 | Thermal Shock Test | -20℃(0.5Hr) ~ +60℃(0.5Hr) for 100 cycles | |

Note:
(1) All the cosmetic specifications are judged before the reliability stress.



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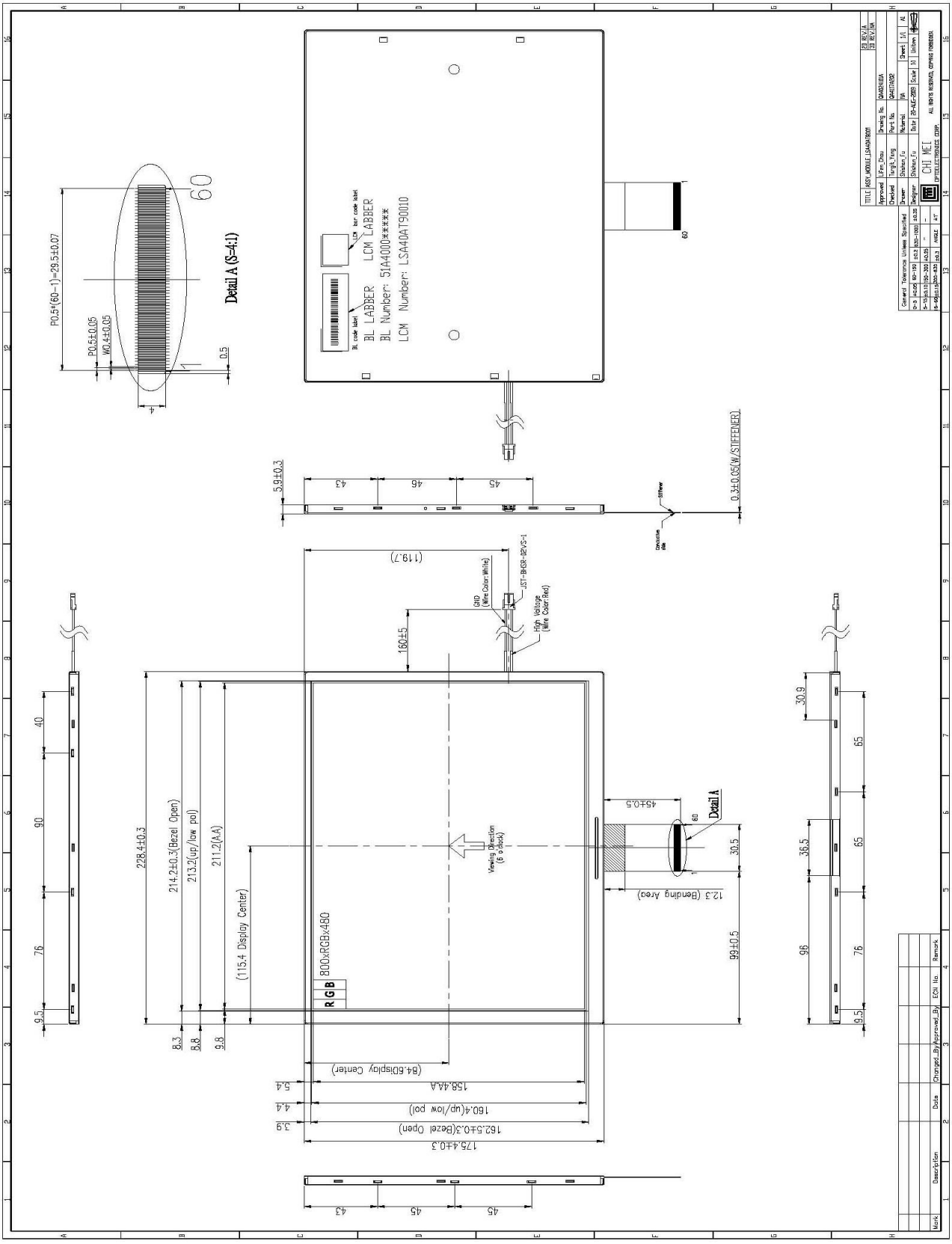
## 12. OUTLINE DRAWING



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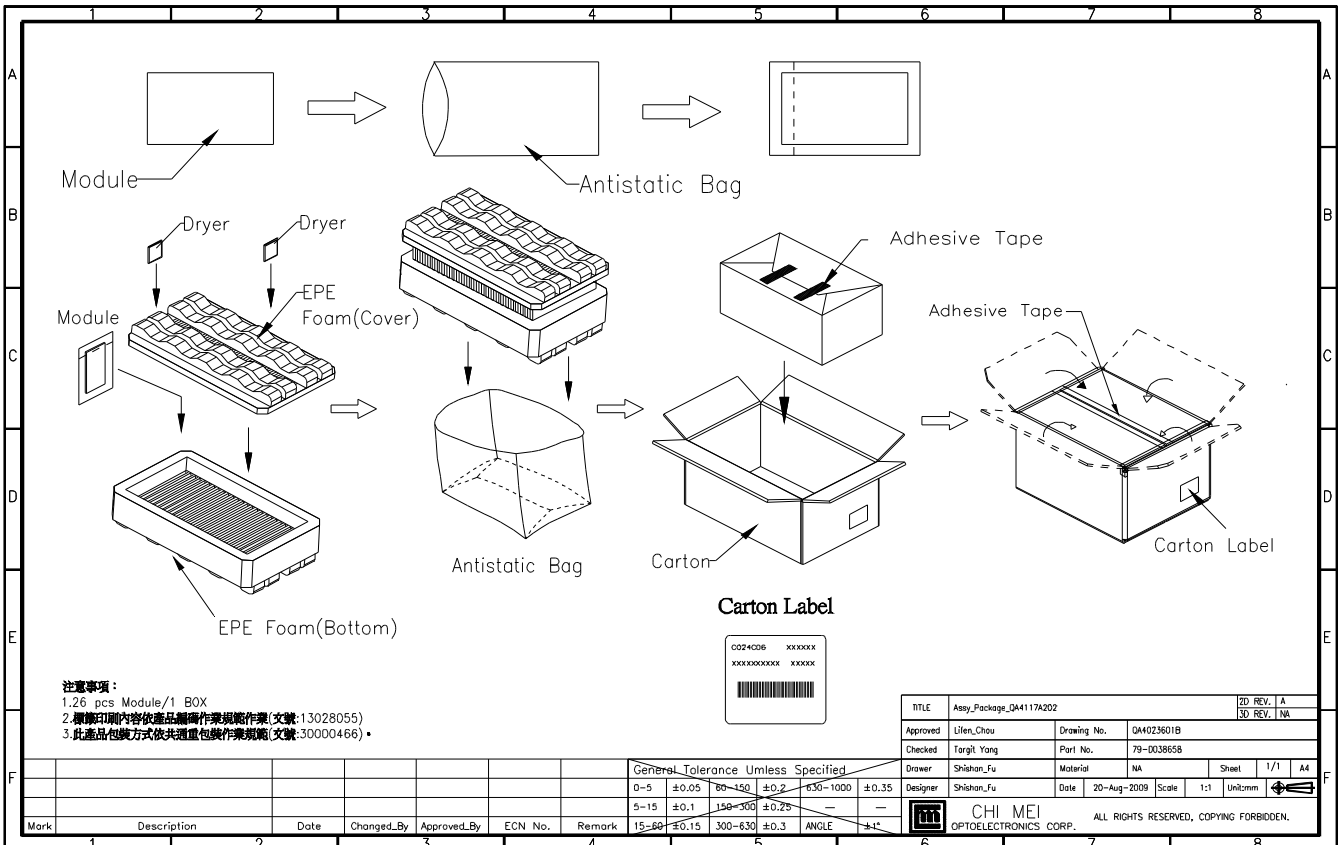
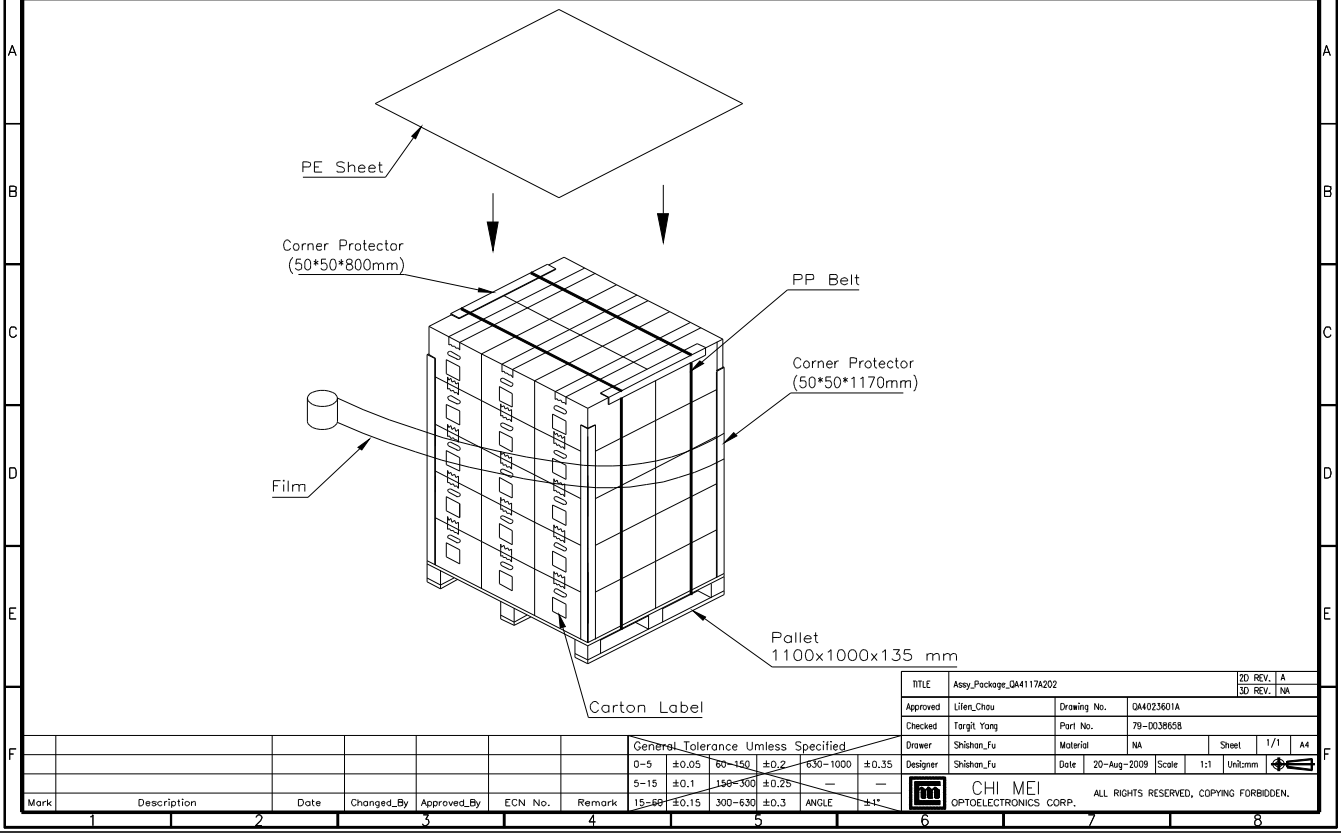
## 13. PACKAGE FORM



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## 14. PRECAUTIONS

Please pay attention to the following when you use this TFT-LCD module.

### 14.1 Mounting Precautions

(1) You must mount a module using arranged in four corners or four sides.

(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) Please attach a transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are determined to the polarizer)

(7) When the surface becomes dusty, please wipe gently with adsorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

### 14.2 Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage : V=±200mV(Over and under shoot voltage)

(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)

(3) Brightness depends on the temperature. (In lower temperature, it becomes lower)
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.

(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.



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(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

**14.3 Electrostatic Discharge Control**

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc. And don't touch interface pin directly.

**14.4 Precautions for Strong Light Exposure**

Strong light exposure causes degradation of polarizer and color filter.

**14.5 Storage**

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

**14.6 Handling Precautions for Protection Film**

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(2) The protection film is attached to the polarizer with a small amount of glue. Is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.

(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.

(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.



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