

LUMMAX ELECTRONICS CO.,LIMITED

PRODUCT SPECIFICATIONS

For Customer: _____ :APPROVALFOR SPECIFICATION

Customer Model No. _____ :APPROVAL FOR SAMPLE

Module No.: SH500J04Z

Date : 2015.10.10

Version : 00

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For Customer's Acceptance:

| Approved By | Comment |
|-------------|---------|
| | |

| PREPARED | CHECKED | VERIFIE D BY QA DEPT | VERIFIE D BY R&D DEPT |
|----------|---------|-------------------------|--------------------------|
| | | | |

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2. Revision Record

| Date | Rev.No. | Page | Revision Items | Prepared |
|------------|---------|------|-------------------|----------|
| 2015.10.10 | 00 | | The first release | |
| | | | | |

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3. General Specifications

SH500J04Z is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 5.0" display area contains 800 x 480 pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

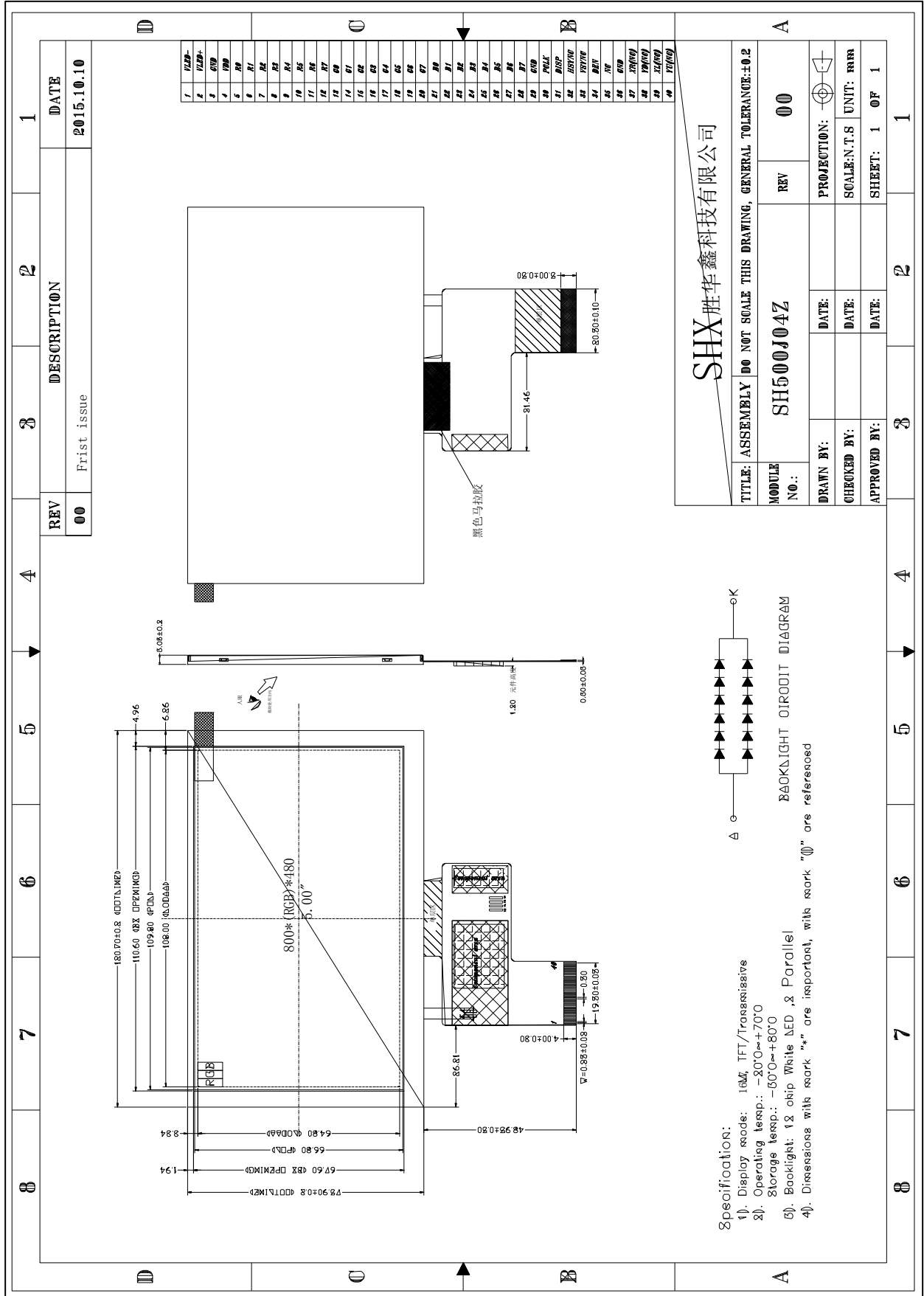
| Item | Contents | Unit | Note |
|-----------------------|--------------------------|---------|------|
| LCD Type | TFT | - | |
| Display color | 16.7M | | 1 |
| Viewing Direction | 6 | O'Clock | |
| Operating temperature | -20~+70 | °C | |
| Storage temperature | -30~+80 | °C | |
| Module size | Refer to outline drawing | mm | 2 |
| Active Area(W ×H) | 108×64.8 | mm | |
| Number of Dots | 800×RGB×480 | dots | |
| Drive IC | HX8264/HX8664 | - | |
| Power Supply Voltage | 3.3 | V | |
| Outline Dimensions | Refer to outline drawing | - | |
| Backlight | 12-LEDs (white) | pcs | |
| Weight | --- | g | |
| Data Transfer | RGB | - | |

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Without FPC and Solder.

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4.Outline.Drawing



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5. Absolute Maximum Ratings (Ta=25 °C)

5.1 Electrical Absolute Maximum Ratings. (Vss=0V, Ta=25 °C)

| Item | Symbol | Min. | Max. | Unit | Note |
|--------------------|------------------|------|---------|------|------|
| PowerSupplyVoltage | VDD | -0.3 | 3.6 | V | 1, 2 |
| InputVoltage | V _{in} | -0.3 | VDD+0.5 | V | |
| CurrentofLED | I _{LED} | 0 | 20 | mA | |

Notes:

1. If the module is above these absolute maximum ratings, it may become permanently damaged.

Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.

2. VDD > V_{SS} must be maintained.

3. Please be sure users are grounded when handling LCD Module.

5.2 Environmental Absolute Maximum Ratings.

| Item | Storage | | Operating | | Note |
|--------------------|---------|------|-----------|------|------|
| | MIN. | MAX. | MIN. | MAX. | |
| AmbientTemperature | -30°C | 80°C | -20°C | 70°C | 1,2 |
| Humidity | - | - | - | - | 3 |

1. The response time will become lower when operated at low temperature.

2. Background color changes slightly depending on ambient temperature.

The phenomenon is reversible.

3. Ta ≤ 40 °C: 85% RH MAX.

Ta > 40 °C: Absolute humidity must be lower than the humidity of 85% RH at 40 °C.

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6. Electrical Specifications and Timing Characteristics

6.1 Electrical Characteristics (V_{SS}=0V, T_a=25 °C)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---------------------|------------------|----------------------|--------------------|------|--------|------|------|
| Powersupply | VDD | T _a =25°C | 2.7 | 3.3 | 3.6 | V | |
| Input voltage | 'H' | V _{IH} | VDD=3.3V 0.7VDD | - | VDD | V | |
| | 'L' | V _{IL} | VDD=3.3V 0 | - | 0.3VDD | V | |
| Current Consumption | I _{CC1} | Normal mode | - | - | -mA | | 2 |
| | I _{CC2} | Sleep mode | - | 0.03 | 0.09 | mA | 2 |

Note:

1: When an optimum contrast is obtained in transmissivemode.

2: Tested in 1 × 1 chessboard pattern.

6.2 LED backlight specification (V_{SS}=0V, T_a=25 °C)

| Item | Symbol | Condition | Min | Typ | Max | Unit | Note |
|-----------------|----------------|-----------------|-----|------|-----|------|------|
| Supply voltage | - | - | - | 19.2 | - | V | 1 |
| Supply current | I _f | - | - | 40 | - | mA | 2 |
| Forward current | Normal | I _{pn} | - | 40 | - | mA | |
| | Dimming | I _{pd} | - | - | - | | |

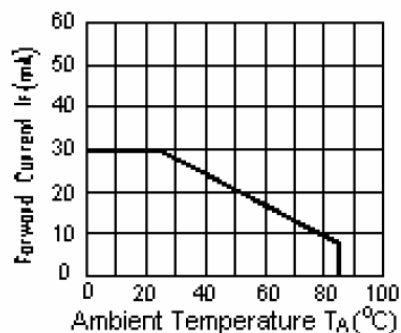
Note:

1: V_{LED} = V_{LED}(+) - V_{LED}(-).

2: The current of LED is 20mA.

A LED drive in constant current mode is recommended.

3: LED power consumption is around 0.768W.



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6.3 Interfacesignals

| Pin | Symbol | Description. |
|-------|--------|----------------------|
| 1 | LED_K | BacklightLEDGround |
| 2 | LED_A | BacklightLEDPower |
| 3 | GND | GND |
| 4 | VDD | Powersupply |
| 5~12 | R0-R7 | Reddatabus |
| 13~20 | G0-G7 | Greendatabus |
| 21~28 | B0-B7 | Bluedatabus |
| 29 | GND | GND |
| 30 | PCLK | Dataclock |
| 31 | DISP | Standbymodeselectpin |
| 32 | HSYNC | LineSYNCsignal |
| 33 | VSYNC | FrameSYNCsignal |
| 34 | DE | DataEnableInput |
| 35 | NC | NC |
| 36 | GND | GND |
| 37 | X1 | TouchPanelControlPin |
| 38 | Y1 | TouchPanelControlPin |
| 39 | X2 | TouchPanelControlPin |
| 40 | Y2 | TouchPanelControlPin |

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6.4 Timing Characteristics

Horizontal timing

| Parameter | Symbol | Spec. | | | Unit |
|--------------------------|--------|-------|------|------|------|
| | | Min. | Typ. | Max. | |
| Horizontal Display Area | thd | 800 | | | DCLK |
| DCLK frequency | fclk | - | 30 | 50 | MHz |
| One Horizontal Line | th | 862 | 1056 | 1200 | DCLK |
| HS pulse width | thpw | 1 | - | 40 | DCLK |
| HS Back Porch (Blanking) | thb | 46 | | | DCLK |
| HS Front Porch | thfp | 16 | 210 | 354 | DCLK |
| DE mode Blanking | th-thd | 85 | 256 | 400 | DCLK |

Vertical timing

| Parameter | Symbol | Spec. | | | Unit |
|--------------------------|--------|-------|------|------|----------------|
| | | Min. | Typ. | Max. | |
| Vertical Display Area | tvd | 480 | | | T _H |
| VS period time | tv | 513 | 525 | 650 | T _H |
| VS pulse width | tvpw | 3 | - | 20 | T _H |
| VS Back Porch (Blanking) | tvb | 23 | | | T _H |
| VS Front Porch | tvfp | 7 | 22 | 147 | T _H |
| DE mode Blanking | tv-tvd | 30 | 45 | 170 | T _H |

Parallel 24-bit RGB mode

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|--------------------------------|--------|------|------|------|-------|---------------|
| CLKIN Frequency | Fclk | - | 40 | 50 | MHz | VDD=3.0V~3.6V |
| CLKIN Cycle Time | Tclk | 20 | 25 | - | ns | - |
| CLKIN Pulse Duty | Tcwh | 40 | 50 | 60 | % | Tclk |
| Time from HSD to Source Output | Thso | 64 | | | CLKIN | - |
| Time from HSD to LD | Thld | 64 | | | CLKIN | - |
| Time from HSD to STV | Thstv | 2 | | | CLKIN | - |
| Time from HSD to CKV | Thckv | 20 | | | CLKIN | - |
| Time from HSD to OEV | Thoev | 4 | | | CLKIN | - |
| LD Pulse Width | Twid | 10 | | | CLKIN | - |
| CKV Pulse Width | Twckv | 66 | | | CLKIN | - |
| OEV Pulse Width | Twoev | 74 | | | CLKIN | - |

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7. Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | |
|-------------------------|-------------|------------------|------------------|------|------|-------------------|------|---|
| Brightness | Bp | $\theta=0^\circ$ | - | 400- | | Cd/m ² | 1 | |
| Uniformity | Δ Bp | $\Phi=0^\circ$ | 75 | 80 | - | % | 1,2 | |
| Viewing Angle | 3:00 | $Cr \geq 10$ | - | 60 | - | Deg | 3 | |
| | 6:00 | | - | 60 | - | | | |
| | 9:00 | | - | 65 | - | | | |
| | 12:00 | | - | 50 | - | | | |
| Contrast Ratio | Cr | $\theta=0^\circ$ | - | 350 | | - | 4 | |
| Response Time | T_r+T_f | $\Phi=0^\circ$ | | 20 | | ms | 5 | |
| Color of CIE Coordinate | W | x | 0.26 | 0.31 | 0.36 | - | 1,6 | |
| | | y | 0.28 | 0.33 | 0.38 | - | | |
| | | Y | - | - | - | - | | |
| | R | x | | | | - | | |
| | | y | | | | - | | |
| | | Y | - | - | - | - | | |
| | G | x | $\theta=0^\circ$ | | | | | - |
| | | y | $\Phi=0^\circ$ | | | | | - |
| | | Y | | - | - | - | | - |
| | B | x | | | | - | | |
| | | y | | | | - | | |
| | | Y | | - | - | - | | - |
| NTSC Ratio | S | | - | 50 | - | % | | |

Note: The parameter is slightly changed by temperature, driving voltage and material.

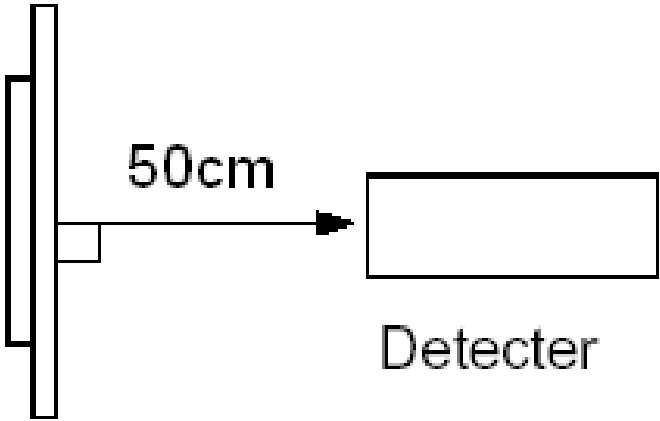
Note 1: The data are measured after LEDs are returned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment PR-705 ($\Phi 8\text{mm}$)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a = 25^\circ\text{C}$.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

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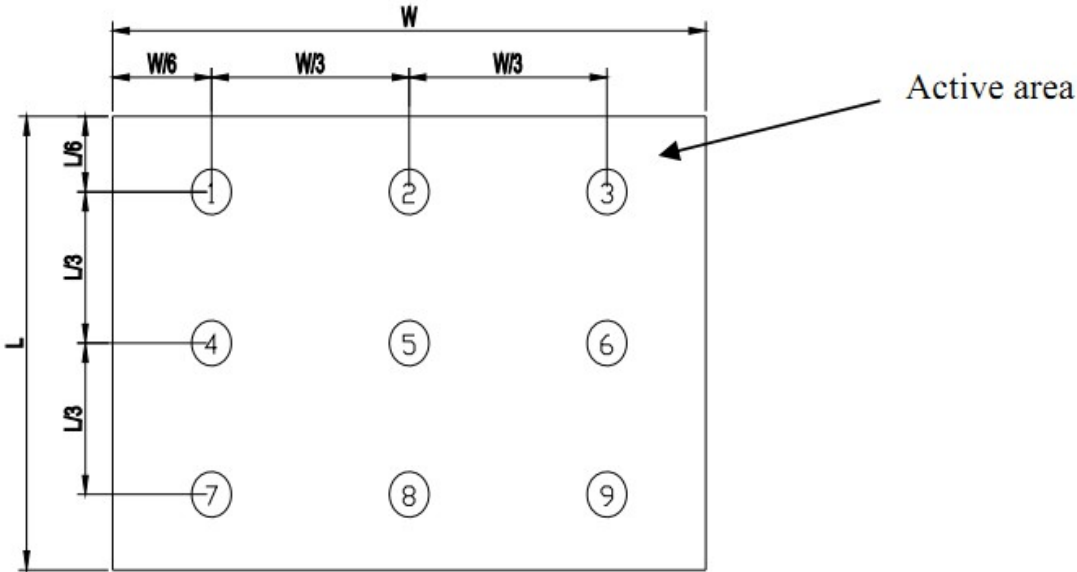


Note2: The luminance uniformity is calculated by using following formula.

$$\Delta B_p = B_p(\text{Min.}) / B_p(\text{Max.}) \times 100(\%)$$

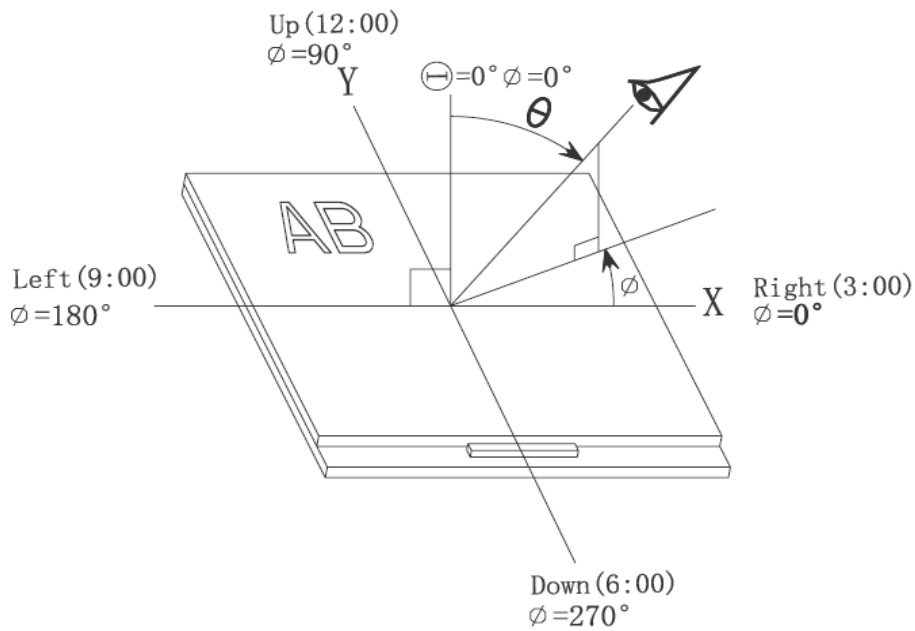
$B_p(\text{Max.}) =$ Maximum brightness in 9 measured spots

$B_p(\text{Min.}) =$ Minimum brightness in 9 measured spots.

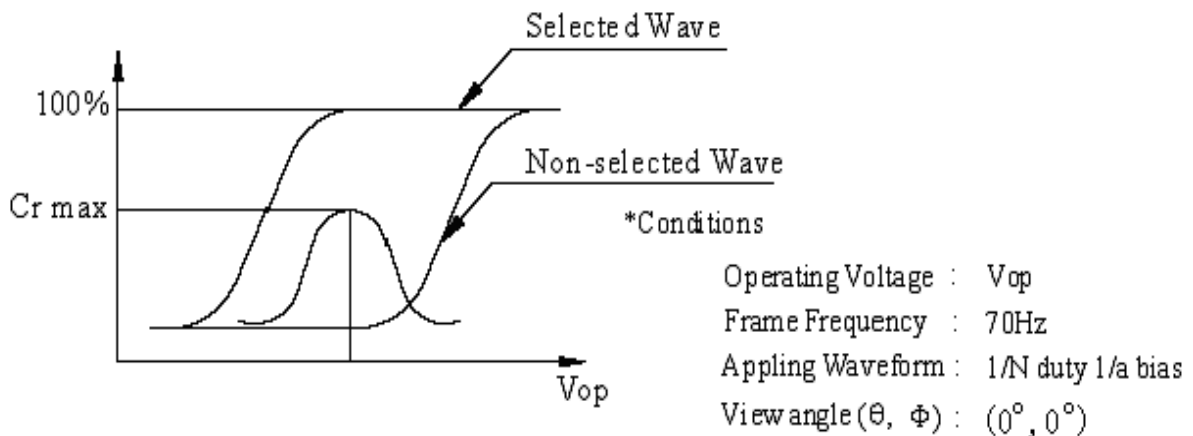


Note3: The definition of viewing angle:
 Refertothegraphbelowmarkedby θ and ϕ

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Note4: Definition of contrast ratio. (Test LCD using DMS501)

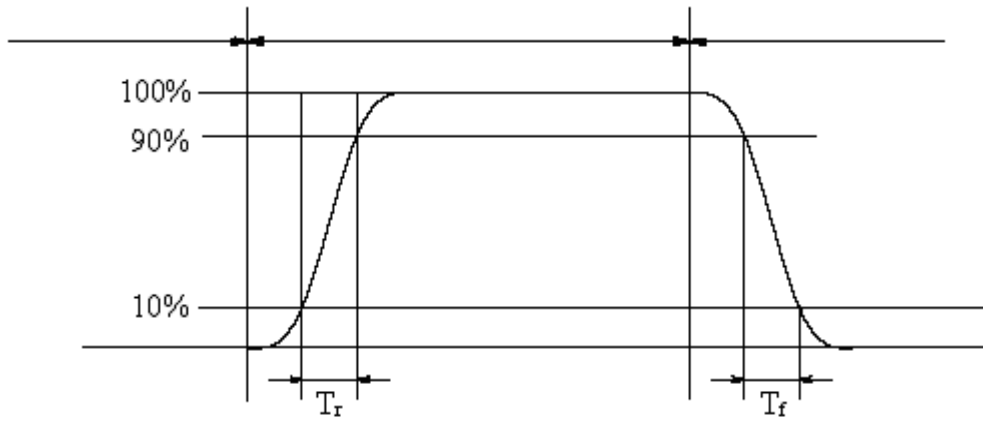


$$\text{Contrast ratio (Cr)} = \frac{\text{Brightness of selected dots}}{\text{Brightness of non-selected dots}}$$

Note5: Definition of Response time. (Test LCD using DMS501):

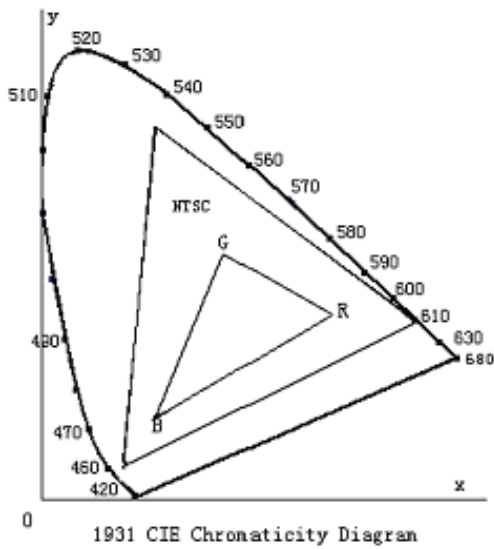
The output signals of photodetector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figures as below.

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The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.

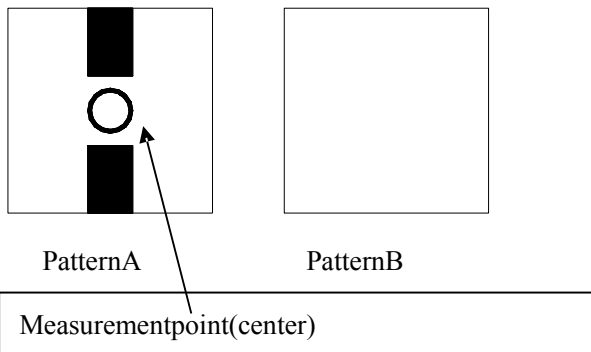


Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 7: Definition of crosstalk.

$$\text{Crosstalk ratio}(\%) = \frac{|\text{pattern A Brightness} - \text{pattern B Brightness}|}{\text{pattern A Brightness}} \times 100$$



Electric volume value = $3F \pm 3Hex$

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8. Reliability Test Items and Criteria

| No | Test Item | Test condition | Criterion |
|----|-------------------------------------|---|--|
| 1 | High Temperature Storage | 80°C±2°C 96H Restore 2 Hat 25 °C Power off | 1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value. |
| 2 | Low Temperature Storage | -30°C±2°C 96H Restore 2 Hat 25 °C Power off | |
| 3 | High Temperature Operation | 70°C±2°C 96H Restore 2 Hat 25 °C Power on | |
| 4 | Low Temperature Operation | -20°C±2°C 96H Restore 4 Hat 25 °C Power on | |
| 5 | High Temperature/Humidity Operation | 60°C±2°C 90%RH 96H Power on | |
| 6 | Temperature Cycle |  30min 5min 30min after 5 cycle, Restore 2 Hat 25 °C Power off | |
| 7 | Vibration Test | 10Hz~150Hz, 100m/s ² , 120min | Not allowed cosmetic and electrical defects. |
| 8 | Shock Test | Half-sine wave, 300m/s ² , 11ms | |
| 9 | ESD Test | Air discharge: +/-8KV, Contact discharge: 4KV | |

Note: Operation: Supply 3.3V for logic system.

The inspection terms after reliability test, as below

| ITEM | Inspection |
|------------|--------------------|
| Contrast | CR>50% |
| IDD | IDD<200% |
| Brightness | Brightness>60% |
| Color Tone | Color Tone +/-0,05 |

9 Quality level

9.1 Classification of defects

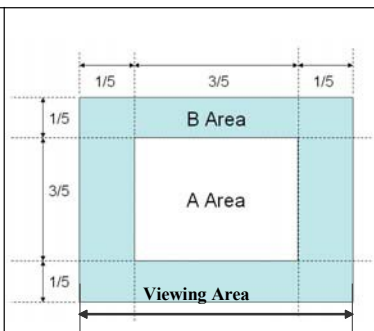
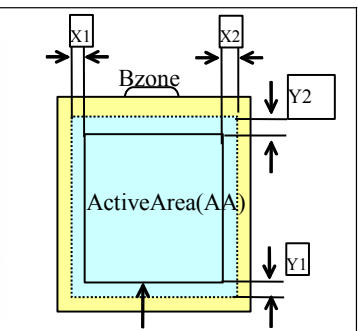
Major defects (MA): A major defect refers to a defect that may substantially

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degrade usability for product applications, including all functional defects (such as no display, abnormal display, open or missing segment, short circuit, missing component), outlined dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

9.2 Definition of inspection range

| | |
|---|--|
| <p>For dot defect of TFTLCD which is not smaller than 3 inches, dividing three areas to make a judgment (according to figure 1).</p> <p>A area: center of viewing area B area: periphery of viewing area C area: Outside viewing area</p> <p>For other defects, dividing two areas to make a judgment (according to figure 2).</p> <p>A zone: Inside Viewing area B zone: Outside Viewing area</p> <p>X1(A.A~V.A): 2mm X2(A.A~V.A): 2mm Y1(A.A~V.A): 2mm Y2(A.A~V.A): 2mm</p> |  <p>Figure 1</p>  <p>Figure 2</p> |
|---|--|

9.3 Inspection items and general notes

| | | |
|-------------------------|---|---|
| <p>General notes</p> | <p>1. Should any defects which are not specified in this standard happen, additional standards shall be determined by mutual agreement between customer and TIANMA.</p> <p>2. Viewing area should be the area which TIANMA guarantees.</p> <p>3. Limit samples should be prior to this inspection standard.</p> <p>4. Viewing judgments should be under static pattern.</p> <p>5. Inspection conditions Inspection distance: 250mm (from the sample) Temperature : 25±5°C Inspection angle : 45 degrees in 60° clockwise direction (all defects in viewing area should be inspected from this direction)</p> | |
| <p>Inspection items</p> | <p>Pinhole, Brightspot, Blackspot, Whitespot, Blackline, WhiteLine, Foreign particle, Bubble</p> <p>Contrast variation</p> <p>Polarizer defect</p> <p>Dot defect (TFTLCD)</p> <p>Functional defect</p> | <p>The color of a small area is different from the remainder. The phenomenon does not change with voltage</p> <p>The color of a small area is different from the remainder. The phenomenon changes with voltage</p> <p>Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass</p> <p>The pixel appears bright or dark abnormally when display</p> <p>No display, Abnormal display, Open or missing segment, Short circuit, False viewing direction</p> |

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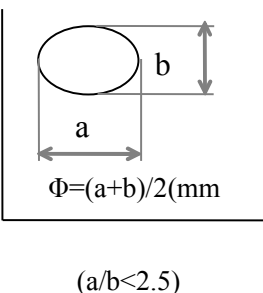
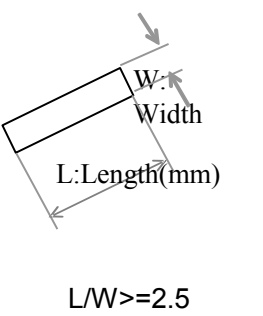
| | | |
|--|-------------|---|
| | Glassdefect | Glasscrack, Shavedcornerofglass, Surplusglass |
| | PCBdefect | Componentsassemblydefect |

9.4 Outgoing Inspection level

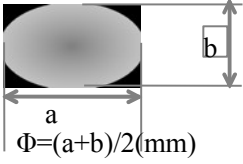
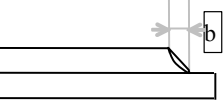
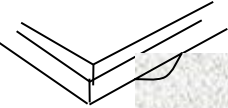

| Outgoing Inspection standard | Inspection conditions | Inspection | | | | |
|------------------------------|-----------------------|------------|------|------|----|-------|
| | | Min. | Max. | Unit | IL | AQL |
| Major Defects | See 8.3 general notes | See 8.5 | | | II | 0.065 |
| Minor Defects | See 8.3 general notes | See 8.5 | | | II | 0.065 |

Note: Sampling standard conform to GB2828

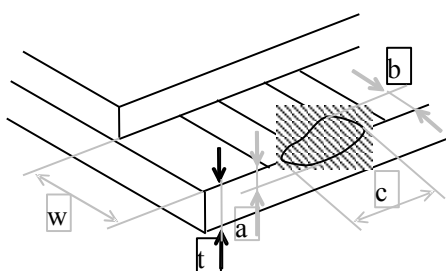
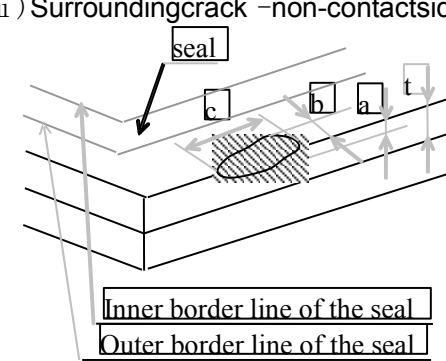
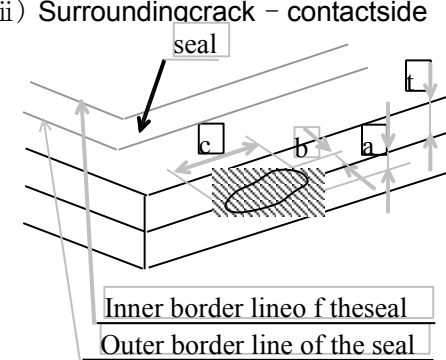
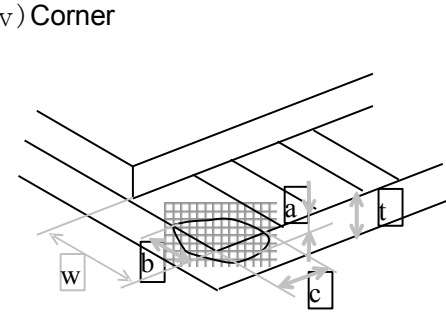
9.5 Inspection Items and Criteria

| Inspection items | | | Judgment standard | | | |
|------------------|---|---|-----------------------------|--------------------------------------|-------------------|-----------|
| | | | Category | | Acceptable number | |
| | | | | | A zone | B zone |
| 1 | Blackspot, White spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass |  | A | $\Phi \leq 0.20$ | Neglected | Neglected |
| | | | B | $0.20 < \Phi \leq 0.25$ | 3 | Neglected |
| | | | C | $0.25 < \Phi \leq 0.3$ | 2 | Neglected |
| | | | D | $0.3 < \Phi \leq 0.4$ | 1 | 3 |
| | | | E | $0.4 < \Phi \leq 0.5$ | 0 | 2 |
| | | | Total defective point (B,C) | | 1 | - |
| | | | | | | |
| 2 | Blackline, White line, and Particle Between Polarizer and glass, Scratch on glass |  | A | $W \leq 0.03$ | Neglected | Neglected |
| | | | B | $0.03 < W \leq 0.05$ $L \leq 3.0$ | 3 | Neglected |
| | | | C | $0.05 < W \leq 0.1$ $L \leq 3.0$ | 2 | Neglected |
| | | | D | $0.05 < W \leq 0.1$ $L \leq 4.0$ | 1 | 3 |
| | | | E | $W > 0.1$ $L > 4.0$ | 0 | 2 |
| | | | Total defective point (B,C) | | 1 | - |
| | | | | | | |
| 3 | Brightspot | any size | | none | none | |
| 4 | Contrast | A | $\Phi < 0.2$ | Neglected | Neglected | |

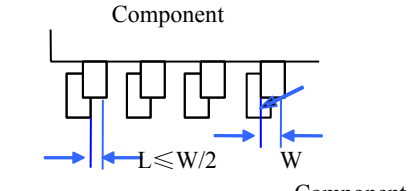
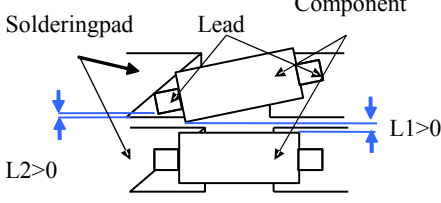
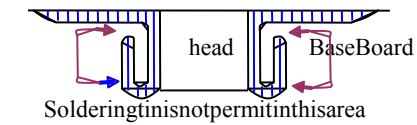
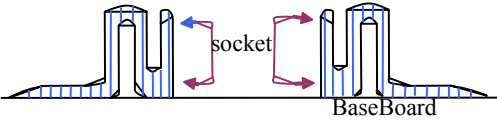
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| | | | | | | |
|----|--|---|--|-----------------------|-----------|-----------|
| | variation |  | B | $0.2 < \Phi \leq 0.3$ | 2 | |
| | | | C | $0.3 < \Phi \leq 0.4$ | 1 | |
| | | | D | $0.4 < \Phi$ | 0 | |
| | | | Total defective point (B,C) | | 3 | |
| 5 | Bubble inside cell | | any size | | none | none |
| 6 | Polarizer defect (if Polarizer is used) | Scratch, damage on polarizer, Particle on polarizer or between polarizer and glass. | Refer to item 1 and item 2. | | | |
| | | Bubble, dent and convex | A | $\Phi \leq 0.1$ | Neglected | Neglected |
| | | | B | $0.1 < \Phi \leq 0.2$ | 2 | Neglected |
| | | | C | $0.2 < \Phi \leq 0.3$ | 1 | 2 |
| 7 | Surplus glass | Stages surplus glass |  $B \leq 0.3 \text{mm}$ | | | |
| | | Surrounding surplus glass |  Should not influence outlined dimension and assembling. | | | |
| 8 | Open segment or open common |  | | | | |
| 9 | Short circuit | | | | | |
| 10 | False viewing direction | | | | | |
| 11 | Contrast ration uneven | According to the limits specimen | | | | |
| 12 | Crosstalk | According to the limits specimen | | | | |
| 13 | Black/White spot (display) | Refer to item 1 | | | | |
| 14 | Black/White line (display) | Refer to item 2 | | | | |

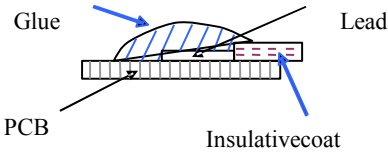
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| Inspection items | | Judgment standard | | | |
|---|--|--|--|---|-----------------------|
| | | Category(application:Bzone) | Acceptable number | | |
| 15 | Glass defect crack | i) The front of lead terminals | A | $a \leq t$, $b \leq 1/5W$, $c \leq 3\text{mm}$ | Max.3 defects allowed |
| | |  | B | Crack at two sides of lead terminals should not cover patterns and alignment mark | |
| | | ii) Surrounding crack - non-contact side | $b < \text{Inner border line of the seal}$ | | |
| | |  | | | |
| iii) Surrounding crack - contact side | $b < \text{Outer border line of the seal}$ | | | | |
|  | | | | | |
| iv) Corner | A | $a \leq t$, $b \leq 3.0$, $c \leq 3.0$ | B Glass crack should not cover patterns and alignment mark and patterns. | | |
|  | | | | | |

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| Inspection items | | Judgment standard | |
|------------------|------------|--|---|
| | | Category(application:Bzone) | |
| 16 | PCB defect | <p>Components soldering: No cold soldering, short, open circuit, burr, tin ball The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1); the sheet component deviation: Pin deviates from the pad and contact with the near components is not permitted (Pic.2)</p> | <p style="text-align: center;">Component</p>  <p style="text-align: center;">Soldering pad Lead Component</p>  |
| | | <p>lead defect: The lead lack must be less than 1/3 of its width; The lead burr must be less than 1/3 of the seam; Impurities connect with the near leads is not permitted</p> | |
| | | <p>Connectors soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted</p> |  <p style="text-align: center;">Soldering tin is not permitted in this area</p>  <p style="text-align: center;">Soldering tin is not permitted in this area</p> |

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| | | |
|--|---|--|
| | <p>Glue on root of the speaker receiver and motor lead: The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.</p> |  |
|--|---|--|

10. Precautions for Use of LCD Modules

10.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

—Isopropyl alcohol

—Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer.

Especially, do not use the following:

—Water

—Ketone

—Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

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9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be careful when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommended condition is:

Temperature: $0^{\circ}\text{C} \sim 40^{\circ}\text{C}$

Relative humidity: $\leq 80\%$

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

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10.3 The LCD modules should be of falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

