

7" WUXGA LCD (Glass + IC)

Specification

Rev. 0.1

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Caution and Handling Precaution

For your end users' safety, it is strongly advised that the items with "*" should be included in the instruction manual of the system which may be issued by your organization.

Japan Display always endeavors to maintain sufficient quality in process of designing and manufacturing. However, to avoid causing extended damages such as accidents resulting in injury or death, fire, or social damages if the LCD display fails, take into consideration safe design such as redundant design, fire-spreading prevention design, over-current prevention design, or malfunction prevention design etc. as a whole set.

For Safety

Warning

The following warning indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.

1) SPECIAL PURPOSES

Japan Display's Standard LCD displays described in this Specification are not customized for applying to equipments (for example: nuclear control systems, airplanes and space vehicles, combustion control systems, various safeguards, medical equipment etc.) of which failures or malfunctions may directly threaten a human life or hurt a human body. When using them for the above equipments, consult with our company beforehand.

Understand that our company cannot take responsibility for the damage etc. occurred by use without consultation.

Caution

The following caution indicates a potentially hazardous situation which may result in minor injury or moderate injury, with incorrect usage.

*1) DISASSEMBLING OR MODIFICATION

DO NOT DISASSEMBLE OR MODIFY the displays. Disassembling the display may result in an electric shock.

Sensitive parts inside LCD display may be damaged, and dusts or scratches may cause burning or breakage of circuits or parts or surface damage of display. Japan Display does not warrant the displays, if customer disassembled or modified them.

*2) BREAKAGE OF LCD PANEL

DO NOT INGEST liquid crystal material, DO NOT INHALE this material, and DO NOT PERMIT this material to contact the skin, if glass of LCD panel is broken.

If liquid crystal material contacts the skin, mouth or clothing, take the following actions immediately.

In case contact to the eye or mouth, rinse with large amount of running water for more than 15 minutes. In case contact to the skin or clothing, wipe it off immediately and wash with soap and large amount of running water for more than 15 minutes.

The skin or clothing may be damaged if liquid crystal material is left adhered.

In case ingestion, rinse out the mouth well with water. After spewing up by drinking large amount of water, get medical treatment.

*3) GLASS OF LCD PANEL

BE CAREFUL WITH CHIPS OF GLASS that may cause injuring fingers or skin, when the glass is broken.

The LCD display has the structure where a plastic film is stuck on a glass surface and glass cannot disperse easily. However, touching a cut surface may cause injuries.

4) ABSOLUTE MAXIMUM RATINGS

DO NOT EXCEED the absolute maximum ratings specified in this Specification. These are the rated values that must not exceed for a LCD display by any means. Since the parts used as a circuit are damaged by fire or breakage and the characteristic may not be recovered when exceeding this rating, take into consideration the variation in ambient temperature, input signal change, and dispersed specification of electric parts etc., and design not to exceed LCD display absolute maximum ratings.

5) POWER PROTECTION CIRCUIT

Employ protection circuit for power supply, for LCD display failures according to the operating condition of a set.

A suitable protection circuit should be applied, based on each system design.

A fuse is not fitted to this display. Therefore, without a suitable power-supply protection device, dust or partial circuit failure may cause overheating and/or burning, which may lead to injury.

6) DISPOSAL

Always comply with all applicable environmental regulations, when discarding the LCD display.

7) EDGES OF PARTS

Be careful about handling edge of glass parts and touch panel to avoid injuring.

For designing the system, give special consideration that the wiring and parts do not touch those edges.

8) RECOMMENDED OPERATING CONDITIONS

Don't exceed "the recommended operation conditions" in this specification. (The LCD display should be used within "the recommended operation conditions".)

The performance and quality of the LCD display are warranted only when the LCD display is used within "the recommended operation conditions". Japan Display never warrants the performance and quality of the LCD display when you use the LCD display over "the recommended operation conditions", although within "the absolute maximum rating".

To use the LCD display over "the recommended operation conditions" may have bad influence on the characteristics and reliability of the LCD display and may shorten the life of the LCD display.

Therefore, when designing the whole set, not to be over "the recommended operation conditions", you should fully take care of supply voltage change, characteristic of connection parts, surge of input-and-output line, and surrounding temperature.

For Designing the System

2-1 DESIGNING ENCLOSURE

1) ASSEMBLY

When the display is assembled into the set, consider the optimum design to prevent display from stress.

*2) TWIST/WARP

When assembling a LCD display in a set and using the set, be careful not to apply stress, such as twist or warp, on the LCD display at designing an enclosure of the set. Twist or warp may cause LCD display failures.

When FPC is bent, FPC radius of curvature should be more than value of recommendation. When a set is designed, ensure that bending and twisting pressures are not applied to the FPC connector.

3) DESIGN ON THE REAR OF A LCD MODULE

Design a set so that the LCD module rear is not pressed by a set enclosure or a cable, etc. Pressing the LCD module rear deforms a panel etc. and may cause uniformity in a display.

4) MOUNTING PARTS

Make sure to design not to be added strong external force on the mounting parts of LCD module. When the parts area stressed, there is a case that drop of some parts and electric short circuit would be cased.

5) GAS GENERATED FROM THE PART MATERIAL FOR A SET

Some plastic materials and shock absorbing materials (rubber) used in the system may generate gases that may cause the deterioration of the polarizer laminated on LCD's panel or internal parts of the LCD module. Prior confirmation is required.

6) GAS GENERATED FROM CASING /PACKAGING MATERIAL FOR A SET

Some materials used for packaging (for which sulfuric acid is used in the recycling process) generate gases that may cause the deterioration of the polarizer laminated on LCD's panel or internal parts of the LCD module. Prior confirmation is required.

2-2. DESIGNING POWER SUPPLIES AND INPUT SIGNALS TO LCD DISPLAY

1) SEQUENCE OF POWER SUPPLIES AND INPUT SIGNALS

Refer to "3 Recommended Operating Conditions for Driving LCD" described in this Specification. If the recommended operating conditions are not followed, it may cause miss-operation of the panel.
In addition, refer to individual specifications for unused terminals.

2) IMAGE STICKING IN A DISPLAY

Design the system not to display the same pattern for a long time.

Continuing the same pattern display for a long time or inputting the signals besides recommendation may cause the phenomenon "image sticking" which remains vaguely after changing patterns.

2-3 DESIGNING FOR BETTER VISIBILITY

1) PANEL ANGLE

Visibility of LCD display deeply depends on the viewing directions. The position and the angle of LCD display in the system should be designed so that the best visibility can be obtained at the actual usage.

2) WINDOW OPENING

Dimensions of window opening of the system's enclosure should be designed as smaller than "Viewing Area" and larger than "Active Area" specified in individual specification in order to prevent that a part of screen is interrupted by the enclosure and disappears.

3) PROTECTIVE COVER/ ULTRA-VIOLET CUT FILTER

In case of severe environmental condition like outdoor usage, a proper transparent protective cover (lens) over LCD display is recommended, to prevent scratches, invasion of dust and water, etc, between the system housing and the LCD display.

It is recommended to apply an ultra-violet filter (less than 390nm cut) onto the LCD display, for outdoor operation.

Strong ultra-violet radiation may damage the panel. However, in that case, transmittance-luminance will decrease. Careful selection of material is required.

Don't expose any parts, except the viewing area, into the direct sunlight, otherwise deterioration may occur.

For Installation in Assembly

3-1 CARRYING

Hold the side of the LCD display when carrying with hand. Holding FPC may cause failures, in the worst case, it may cause smoke or burn.

Protection (e.g. gloves) for fingers and hands is recommended, to avoid injury by broken glass.

3-2 CAUTIONS TO PREVENT FROM ELECTROSTATIC DESTRUCTION UNDER ASSEMBLY WORK

Consider the following to prevent the static electricity from generating under assembly work. High-voltage static electricity discharge destroys the circuit inside the display and it may cause failures.

1) HUMIDITY

Maintain a work place in the range of 50 to 70% of relative humidity, to prevent generation and discharge of static electricity.

2) GROUNDING

2-1) Cover the floor of a work area and a work desk with a conductive mat, and ground them, through resistance with range of 0.5 M Ω to 1M Ω , to prevent discharge all at once.

2-2) Workers must wear a grounded wrist band.

2-3) Ground all metallic tools, jigs and equipment, such as a soldering iron and a screw driver, jigs, conveyors, or metallic work benches, which are to be used for assembly work.

3) IONIZER

Using ionizer (an antistatic blower) is recommended at working area in order to reduce electro-static voltage.

4) REMOVING PROTECTION FILM

The protection film is stuck on an LCD panel before its shipment to prevent dust or scratch on the panel during transportation, assembly work or otherwise. Remove a protection film on an LCD panel near the last process of an assembly to prevent dust and scratch on the panel.

However, remove the film in advance in case of a set attached a display is inserted into high temperature chamber for aging etc. If it is left without removing the film, it may cause irregular polarizer surface.

When removing the protection film, peel off the tag carefully and slowly, spending more than 1 second.

In peeling off the protection film, blow the film using ionizer to eliminating ESD from the film.

Removal which does not comply with the above procedure may generate ESD and damage electric circuit of a LCD display.

5) Do not touch bare metal portions of examination /inspection equipment. It causes to discharge electric charge of an object or a human body.

6) Do not touch the mounting parts on PCB LCD display, circuit patterns or FPC terminals with worker's hand or conductive tools.

3-3 DUST AND STAIN PREVENTION

1) WORKING AREA

Handle the LCD display in the room without metallic dust. Especially when metallic dust adheres to the LCD display, an internal electric circuit makes short-circuited and it may cause failures.

2) FINGER PRINT

Handle the LCD display fingerstalls or soft and dust-free gloves that do not produce dust when performing incoming inspection of displays or assembling sets. Handling them with bare hand may damage display quality.

***3) WIPING OFF DUST ON THE PANEL**

When LCD panel becomes dirty, wipe the panel surface off softly with absorbent cotton or another soft cloth.

If necessary, breathe upon the panel surface and then wipe off immediately and softly again.

Be careful not to spill organic solvents into the inside of LCD display. The organic solvents may damage driver IC and PCB area used inside display.

The polarizer laminated to LCD panel and adhesives may be damaged by organic the solvents, so do not use any organic solvents for wiping off LCD panel.

Gently wipe away surface dirt with a soft cloth containing ethanol. Don't use anything other than ethanol or water, as it may cause damage

4) PROTECTION AGAINST ADHESION OF ADHESIVE OR GREASE ON A DISPLAY

Be careful not to attach adhesive or grease etc. used for the assembly of a set on a LCD display. It is difficult to remove them without damaging display quality.

***5) WATER DROP ON A DISPLAY**

Do not leave water drop attached on a display. When water drop etc. is attached, wipe it off with absorbent cotton or soft cloth etc. immediately. If it is left without wiped off, a display discolors, or it causes spots. Moreover, moisture's infiltration into an inside causes failures.

Avoid the dewing or water condensation.

The indication sides discolor and stain upon contact with water. And, damage may occur if water penetrates the inside.

6) HANDLING IN THE CORROSIVE ATMOSPHERE

Do not blow gas or do not use a LCD display besides the normal atmosphere. It may cause failures.

3-4 BENDING / TWISTING OF LCD DISPLAY UNDER ASSEMBLY

1) INSTALLING LCD DISPLAY TO THE ENCLOSURE

Do not bend or twist LCD display even momentary when LCD display is installed into an enclosure of the system.

Bending or twisting LCD display may cause its damages.

2) FOR PREVENTION OF CATCHING FPC

Be careful not to let interface FPC etc. caught in a set enclosure and a LCD display while assembling a LCD display in a set.

Assembling with FPC caught in may cause bending, twist of a LCD display, or damage and failure of FPC.

3-5. MECHANICAL FORCES

***1) STRONG MECHANICAL SHOCK**

Avoid strong mechanical shock, such as dropping the LCD from the work bench, or knocking it against a hard object.

These may cause the glass panel to crack, or cause other miss-operation.

***2) EXCESSIVE FORCE**

Avoid applying excessive force, like pushing the surface of LCD panel. This may cause scratches or breakage of the panel, or a failure of the display

***3) PREVENTION FOR SCRATCHES ON A DISPLAY**

Be careful not to touch hard things, such as a tool etc., press a display with them or rub a display with them.

Moreover, be careful not to put heavy things, such as a tool etc., or pile up LCD displays.

As polarizing plates used for a display is easy to be damaged, it may cause scratches, trace, or breakage of the plate.

*4) HOW TO CONNECTION OF FPC

Be careful not to apply a strong external force to FPC of a LCD display when inserting or removing FPC into a connector of a set. A strong external force may damage connection of FPC.

Insert them correctly so that interface FPC and a connector of a set are not inserted oblique or half, and be sure to check them. When inputting signals etc. without inserting them correctly, it may cause failures of circuit parts.

5) HANDLING FPC

Be careful not to pull or damage the FPC, to avoid mechanical damage in FPC and connection part of FPC and cell. In addition, be careful not to be added strong external force to FPC. When the external strong force is added to FPC, it may cause display failures due to breakage of mounting parts and circuit on FPC.

3-6. OPERATION

Be sure that the following caution should be taken under assembly and inspection of the system.

1) POWER SUPPLY WILE WORKING/ASSEMBLING

Be sure to turn off the power of a set while working. Pulling out and inserting a LCD display connector with the power of a set turned on may damage a LCD display electric circuit. When turning on the power in a testing process, an inspection process etc., use the power supply and input signals for a drive unit which satisfy the power supply sequence described in this Specification.

For Transportation and Storage

1) STORAGE UNDER HIGH TEMPERATURE AND HIGH HUMIDITY

Be careful not to store a LCD display for a long time (about one month or more) under the condition of high temperature and high humidity (35°C or more, 70% or more of relative humidity). This may deteriorate display quality.

When it is necessary to store unavoidably for a long term, in the state of packing by our company (before opening), store it within the range of 0°C to 35°C and in the dry place of 70% or less of relative humidity.

2) SOLIDIFICATION ON THE LIQUID CRYSTAL IN CRYOGENIC CONDITION

Since a temperature lower than a rated storage temperature described in this Specification may damage a LCD display liquid-crystal-display panel due to the solidification or contraction etc. On liquid crystal, be careful not to leave it in such a place.

3) BE CAUTIOUS OF STRONG ULTRAVIOLET

Be careful not to expose a LCD display to the sunlight or a fluorescent light directly to protect a LCD display from strong ultraviolet, when storing displays for a long term.

4) CLEANLINESS

Keep the LCD display in clean place, because any dust, hard particle may damage the polarizer, or dust invades the inside of the LCD display.

*5) CONDENSATION OF WATER

The displays should be stored under a condition where no condensation of water is allowed. It may cause miss-operation or defects. Be especially careful not to make a display work under the condition that condensation of water appears.

6) REPACKAGING

Use an original packing box and original packing material, and pack this LCD display with the same original method and same kind of desiccant, when transporting and storing it again after opening it by customer.

7) NOTES FOR THE ADOPTION OF NEW PACKING MATERIAL

Since some of the cartons for packing or the rubber parts etc. generate corrosive gas, confirm a reliability check in the set assembling state or the packing state before the adoption.

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1 Scope

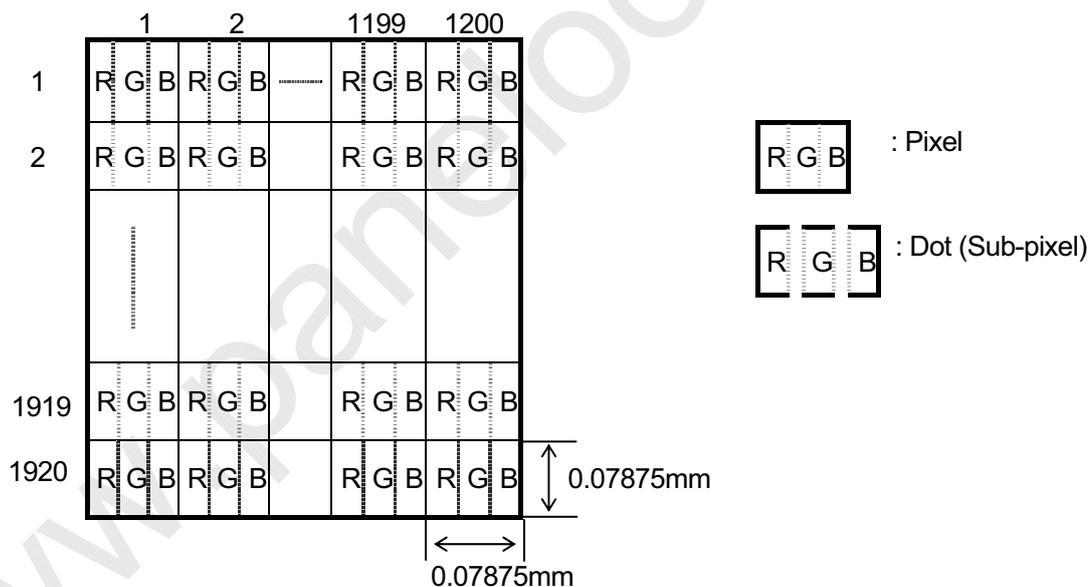
This specification shall be applicable to TFT-LCD, designed for tablet.

2 Product Specifications

2.1 General Specifications

| Item | Specifications | Remark |
|--------------------|-----------------------------------------------------------------------------------|--------|
| Display Mode | Dual Compatible Domain Color transmissive Type (16,777,216colors), Normally Black | |
| Driving Method | TFT active matrix, Low-temperature poly-silicon | |
| Input Signals | MIPI-DSI | |
| Outside Dimensions | 98.7(W) x 160.8(H) x 1.975(D) (mm) (typ.) | |
| Active area | 94.5(W) x 151.2(H) (mm) | |
| Number of Pixels | 1200 (W) x 1920 (H) | 1) |
| Pixel Pitch | 0.07875 (W) x 0.07875 (H) (mm) | 1) |
| Pixel arrangement | RGB Vertical stripe | |

Note 1) Refer to the below.



2.2 Absolute Maximum Ratings

| Item ¹⁾ | Symbol | Min. | Max. | Unit | Remark |
|-------------------------------|---------------------|------|-----------|------|---------------|
| Power supply voltage (Analog) | VDD-GND | -0.3 | 6.0 | V | |
| | VDDp-GND | -0.3 | 6.0 | V | |
| Power supply voltage (Logic) | IOVCC | -0.3 | 4.6 | V | |
| Input signal voltage (RES) | V _I | -0.3 | IOVCC+0.3 | V | XRES |
| Input signal voltage (DSI) | V _{I(DSI)} | -0.3 | 1.8 | V | |
| Operating temperature | T _{OP} | -10 | +60 | °C | ²⁾ |
| Storage temperature | T _{STG} | -30 | +70 | °C | ²⁾ |

Note 1) The absolute maximum ratings are the values that must not be exceeded at any time for this product. It is not allowed for any of these ratings to be exceeded. Should a display be used with any of the absolute maximum ratings exceeded, the characteristics of the display may not be recovered, or in an extreme case, the display may be permanently destroyed.

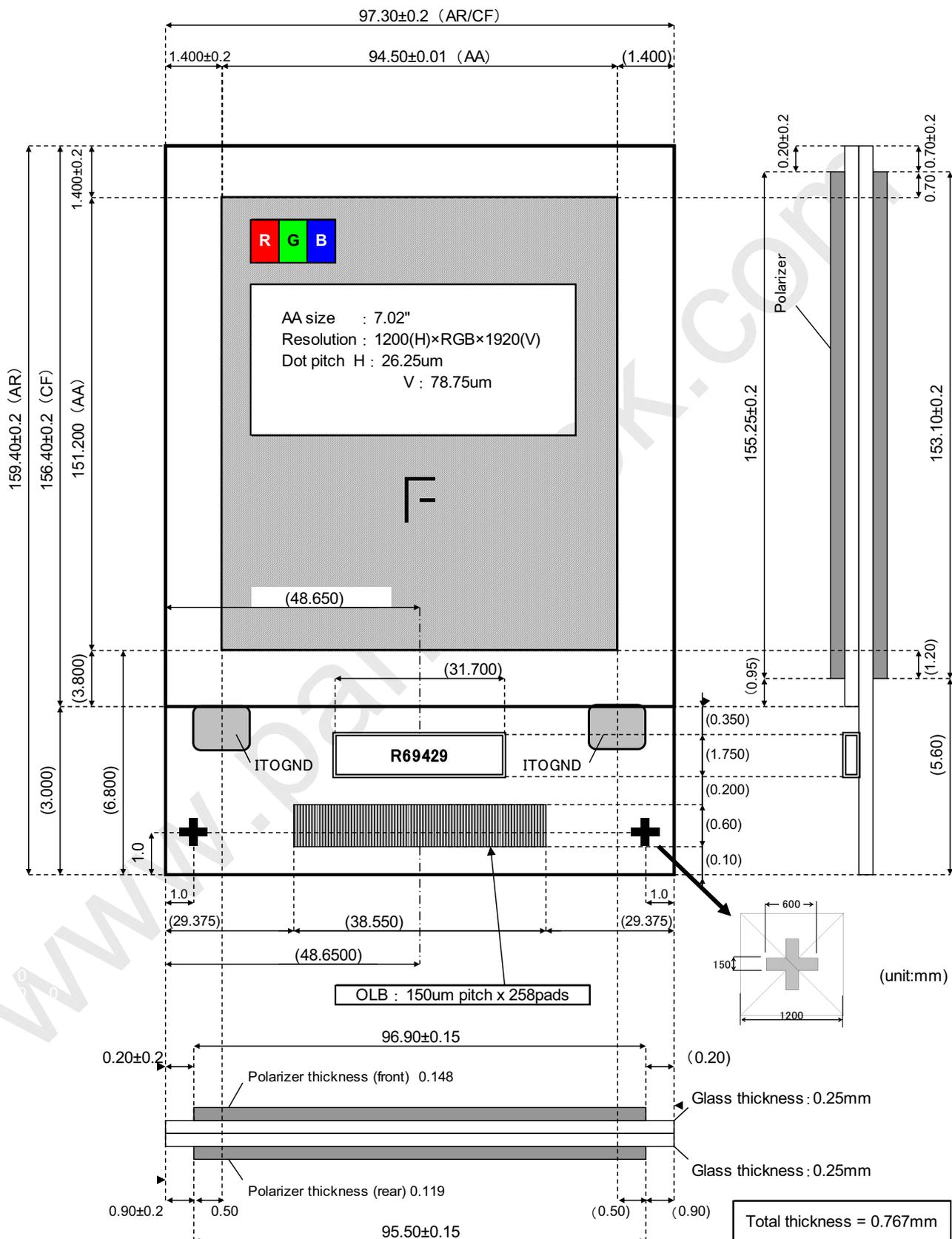
Therefore, when designing a system incorporating the display, make sure that adequate attentions be paid to the variations in the supply voltages, the characteristics of parts that are connected, surges in the input and output lines, and the ambient temperatures.

Note 2) Should be no condensation.

2.3 Mechanical Specifications

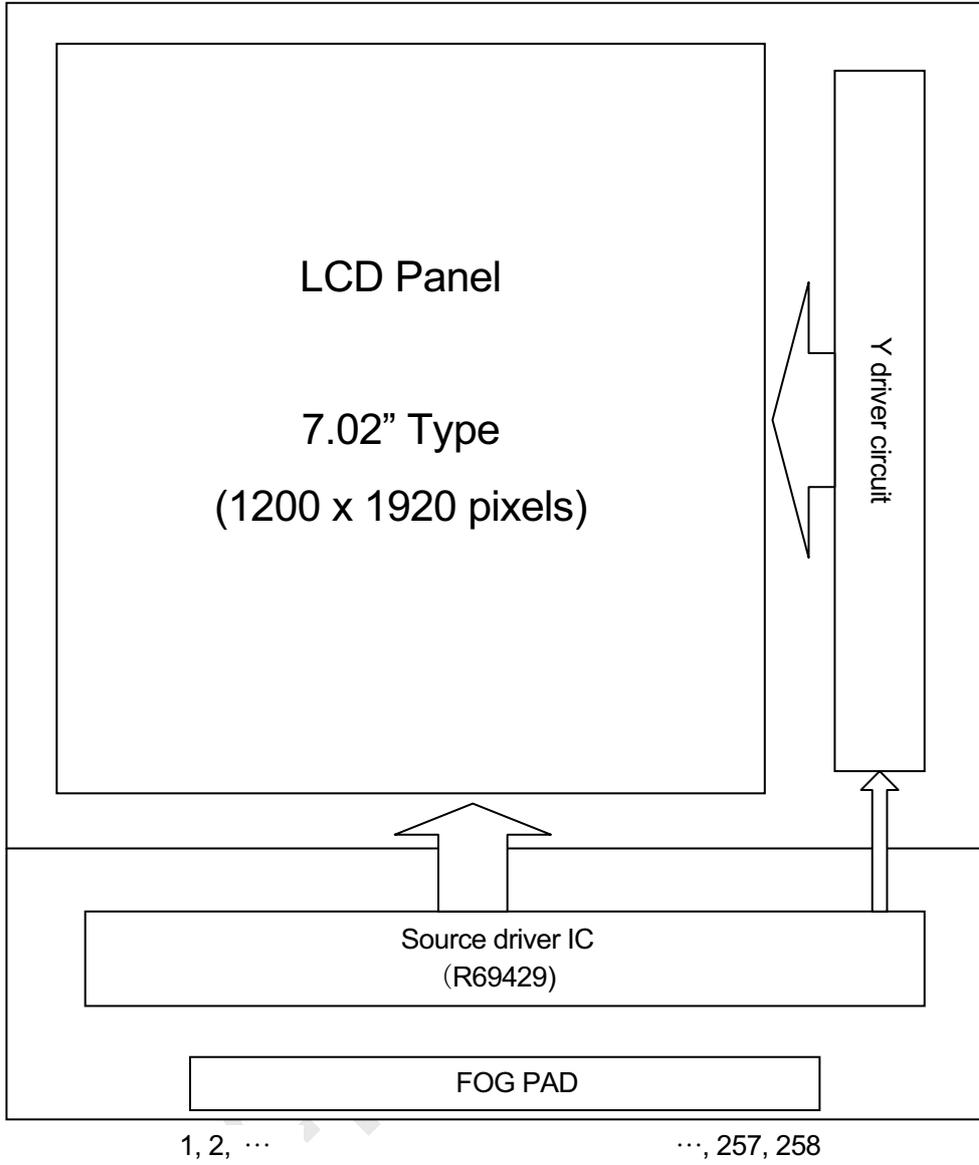
2.3.1 Outline Drawing

Unit: mm



2.4 Electrical Specifications

2.4.1 Block Diagram



2.4.2 PAD Assignment

Please refer to the other file of referential schematic of FPC.

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3 Recommended Operating Conditions for Driving LCD

(Ta=25°C)

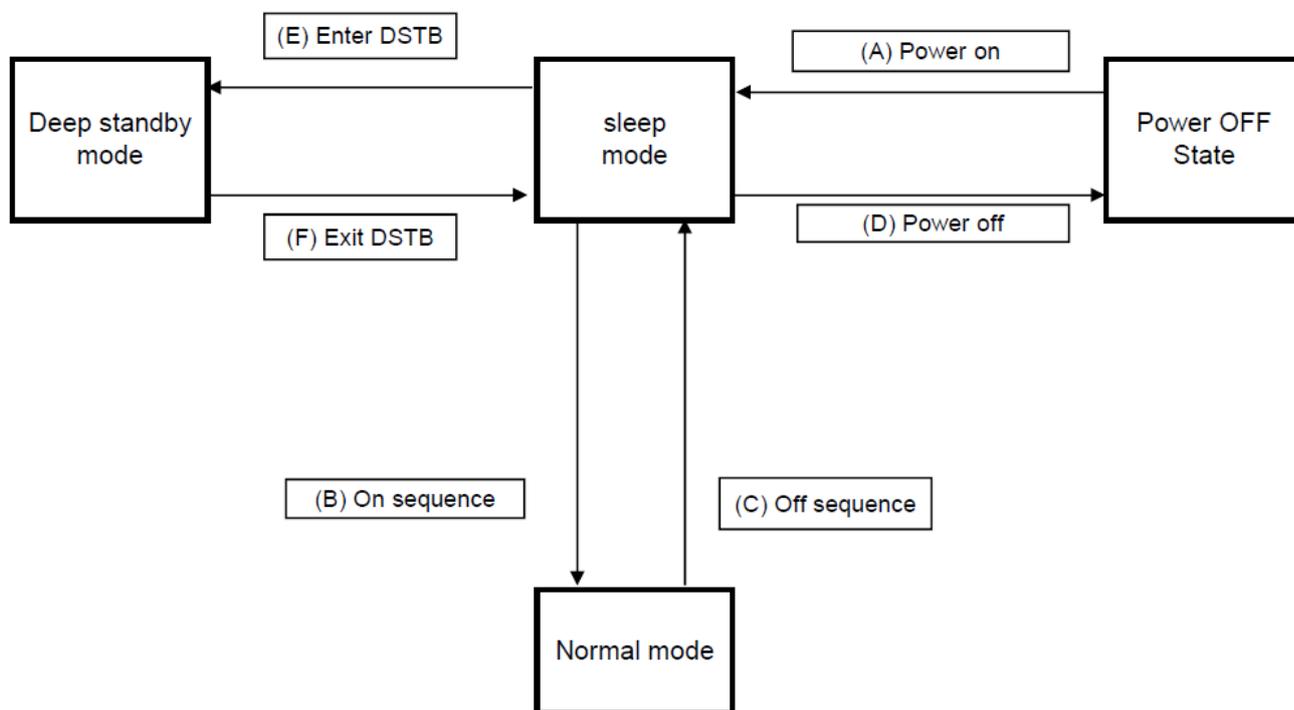
| Item | Symbol | Min. | Typ. | Max. | Unit | Remark | |
|---------------------------------|-----------------------------------|----------------------|------|-----------|------|--------|---------------------|
| Power supply voltage for Analog | VSP | 5.3 | 5.5 | 5.7 | V | | |
| | VSN | -5.7 | -5.5 | -5.3 | V | | |
| Power supply voltage for Logic | IOVCC | 1.70 | 1.80 | 1.90 | V | | |
| Input signal voltage (RES) | V _{IL} | 0 | - | 0.3*IOVCC | V | XRES | |
| | V _{IH} | 0.7*IOVCC | - | IOVCC | V | | |
| Output signal voltage (TE) | V _{OL} | 0 | - | 0.2*IOVCC | V | TE | |
| | V _{OH} | 0.8*IOVCC | - | IOVCC | V | | |
| Input signal voltage (DSI) | Low level | V _{IL(DSI)} | -50 | - | 550 | mV | Low Power Receiver |
| | High level | V _{IH(DSI)} | 880 | - | 1350 | mV | |
| | Input voltage | V _{CMRX} | 70 | - | 330 | mV | High Speed Receiver |
| | Differential input low threshold | V _{IDTL} | -70 | - | - | mV | |
| | Differential input high threshold | V _{IDTH} | - | - | 70 | mV | |

Note 1) The recommended operating conditions refers to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be within the absolute maximum ratings. Accordingly, please make sure that the display is used within this range.

3.1 Command sequence

3.1.1 Status Flow

(1200RGBx1920, R69429, MIPI 4lane)



3.1.2 Sequence

(A) Power on

| sequence | DataTyp (hex) | index (hex) | parameters # (hex) | description | comment |
|-----------------|------------------|----------------|-----------------------|-------------------------|---------------------------------------------------------------------------------------|
| POWER OFF STATE | | | | | |
| PWR supply on | | | | IOVDD on | DSI input should be at GND level while IOVDD off. |
| wait 5ms | | | | | |
| PWR supply on | | | | VDDA(VSP, VSN, PWR) on | |
| wait 50ms | | | | | |
| RESET L->H | | | | RESET L->H | |
| wait 10ms | | | | | |
| PWR supply off | | | | VDDA(VSP, VSN, PWR) off | (*1)Can skip "VDDA off" in case of going to normal mode without staying sleep status. |
| SLEEP MODE | | | | | |

(B) On sequence

| sequence | DataTyp (hex) | index (hex) | parameters # (hex) | description | comment |
|----------------------------|------------------|----------------|--------------------------------------|--------------------------------------|---------|
| SLEEP MODE | | | | | |
| ↓ | | | | | |
| PWR supply on wait 50ms | | | | VDDA(VSP, VSN, PWR) on | |
| command | 05 | 01 | - - | soft reset | |
| wait 5ms | | | | | |
| command | 23 | B0 | 1 00 | MCAP | |
| command | 29 | B3 | 1 04 2 08 3 00 4 22 5 00 | Interface setting | |
| command | 29 | B4 | 1 0C | Interface ID setting | |
| command | 29 | B6 | 1 3A 2 D3 | DSI control | |
| command | 15 | 3A | 1 77 | set pixel format | |
| command | 39 | 2A | 1 00 2 00 3 04 4 AF | set column address | |
| command | 39 | 2B | 1 00 2 00 3 07 4 7F | set page address | |
| send image | 39 | 2C/3C | | write memory / write memory continue | |
| command | 05 | 11 | - - | exit sleep mode | |
| wait 120ms | | | | | |
| command | 05 | 29 | - - | set display on | |
| ↓ | | | | | |
| NORMAL MODE | | | | | |

(C) Off sequence

| sequence | DataTyp (hex) | index (hex) | parameters # (hex) | description | comment |
|----------------|------------------|----------------|-----------------------|-------------------------|---------|
| NORMAL MODE | | | | | |
| ↓ | | | | | |
| command | 05 | 28 | - - | set display off | |
| wait 20ms | | | | | |
| command | 05 | 10 | - - | enter sleep mode | |
| wait 80ms | | | | | |
| PWR supply off | | | | VDDA(VSP, VSN, PWR) off | |
| ↓ | | | | | |
| SLEEP MODE | | | | | |

(D) Power Off

| sequence | DataTyp (hex) | index (hex) | parameters # (hex) | description | comment |
|-----------------|------------------|----------------|-----------------------|-------------|---------------------------------------------------|
| SLEEP MODE | | | | | |
| ↓ | | | | | |
| RESET H->L | | | | | |
| PWR supply off | | | | IOVcc off | DSI input should be at GND level while IOVcc off. |
| ↓ | | | | | |
| POWER OFF STATE | | | | | |

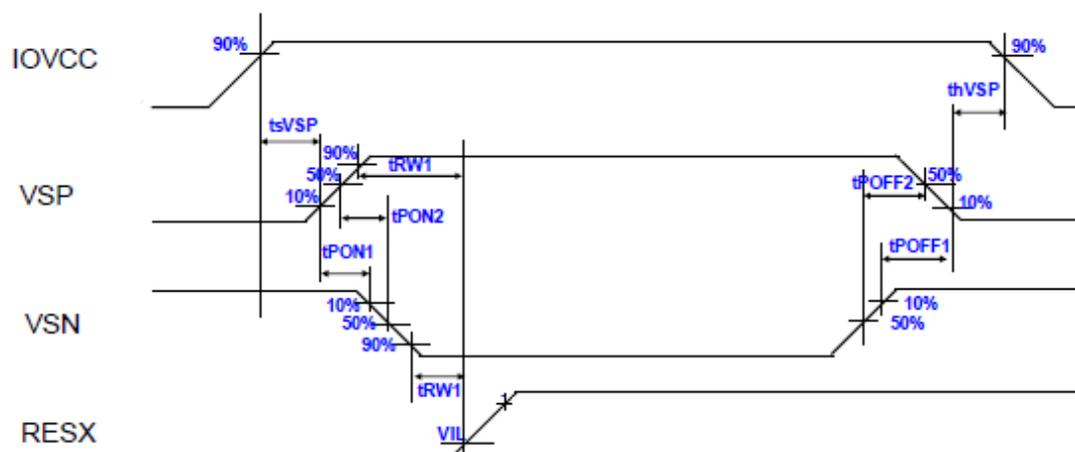
(E) Enter DSTB

| sequence | DataTyp (hex) | index (hex) | parameters # (hex) | description | comment |
|------------|------------------|----------------|-----------------------|-------------|---------|
| SLEEP MODE | | | | | |
| ↓ | | | | | |
| command | 23 | B0 | 1 00 | MCAP | |
| command | 23 | B1 | 1 01 | DSTB=1 | |
| ↓ | | | | | |
| DSTB MODE | | | | | |

(F) Exit DSTB

| sequence | DataTyp (hex) | index (hex) | parameters # (hex) | description | comment |
|----------------|------------------|----------------|-----------------------|---------------------------|---------------------------------------------------------------------------------------|
| DSTB MODE | | | | | |
| ↓ | | | | | |
| RESET H -> L | | | | | |
| wait 10ms | | | | | |
| PWR supply on | | | | VDDA(AVDD+,AVDD- PWR) on | |
| wait 50ms | | | | | |
| RESET L->H | | | | RESET L->H | |
| wait 10ms | | | | | |
| PWR supply off | | | | VDDA(AVDD+,AVDD- PWR) off | (*1)Can skip "VDDA off" in case of going to normal mode without staying sleep status. |
| ↓ | | | | | |
| SLEEP MODE | | | | | |

3.1.3 Power Supply Sequence



| Item | Symbol | Unit | Min | Max |
|---------------------------|--------|------|-----|-----|
| IOVCC on to VSP on time | tsVSP | ms | 1 | - |
| VSP on to VSN on time | tPON1 | ms | 0 | - |
| VSN on to REST on time | tRW1 | ms | 1 | - |
| VSN off to VSP off time | tPOFF1 | ms | 0 | - |
| VSP off to IOVCC off time | thVSP | ms | 0 | - |

4 Product Specifications

4.1 Electric Characteristic Test

4.1.1 Common conditions for Inspections

Ambient temperature : $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Ambient humidity : $60 \pm 20\%RH$

Supply voltage : $IOVCC=1.8V, VSP = 5.5V, VSN= -5.5V$

4.1.2 Consumption Current

Note) Reference Data

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------|-------------|------|------|------|------|---------------|
| Panel Consumption | I_{IOVCC} | - | (12) | (15) | mA | White Pattern |
| | I_{VSP} | - | (10) | (20) | mA | |
| | I_{VSN} | - | (10) | (20) | mA | |

These value depend on the FPC design and bonding condition.

4.2 Optical Characteristics

4.2.1 Common Conditions for Inspections

Ambient temperature : $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$

The other conditions are the same as those under 4.1.1 Common Verification Conditions.

For Test Procedures, see 6.1 Optical Test Procedures.

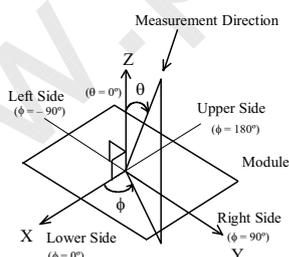
4.2.2 Optical Specifications

Note) Reference data. Below value depend on the backlight design and performance.

| Item | Symbol | Conditions | Specifications | | | Unit | Remark | |
|-----------------|----------|----------------------|----------------------|------|------|------|--------|------|
| | | | Min. | Typ. | Max. | | | |
| Contrast ratio | CR | Display: White/Black | - | 1100 | - | - | | |
| Viewing Angle | θ | CR>10 | $\phi = 180^{\circ}$ | - | 80 | - | deg | 1)2) |
| | | | $\phi = 0^{\circ}$ | - | 80 | - | deg | |
| | | | $\phi = -90^{\circ}$ | - | 80 | - | deg | |
| | | | $\phi = +90^{\circ}$ | - | 80 | - | deg | |
| Transmittance | L | Displayed White | - | 5.2 | - | % | | |
| Displayed Color | X_R | Displayed red | - | 0.64 | - | - | | |
| | Y_R | | - | 0.33 | - | - | | |
| | X_G | Displayed Green | - | 0.31 | - | - | | |
| | Y_G | | - | 0.61 | - | - | | |
| | X_B | Displayed Blue | - | 0.15 | - | - | | |
| | Y_B | | - | 0.05 | - | - | | |
| | X_W | Displayed White | - | 0.31 | - | - | | |
| Y_W | - | | 0.33 | - | - | | | |
| NTSC Ratio | | | - | 71.5 | - | % | | |
| Gamma | | | - | sRGB | - | - | | |
| Cross Talk | | | - | - | 4 | % | | |

Note 1) The definition of the Viewing Angle is as below figure.

Note 2) This display has no support for readability for both portrait and landscape angle of LCM display when user is wearing polarizing sunglasses



4.3 Reliability Test

4.3.1 Electrical / Mechanical / Environmental Test

After the tests as listed below have been performed, this display shall satisfy the criteria as listed under 4.3.2. However, only a single item of these tests shall be executed on a single display. A number of test items shall not be executed on a single display.

| Test Item | Test Conditions | Remark |
|----------------------------------------------|----------------------------------------------------------------------------------------|--------------|
| High Temperature Operation | 60°C, 240 hours | Operating |
| Low Temperature Operation | -10°C, 240 hours | Operating |
| High Temperature and High Humidity Operation | 40°C, 95%, 240 hours | Operating |
| High Temperature Storage | 70°C, 240 hours | Storage |
| Low Temperature Storage | -30°C, 240 hours | Storage |
| High Temperature and High Humidity Storage | 60°C, 90%, 240 hours | Storage |
| Thermal Shock | -30(30min) ⇔ 70(30min), 27 cycles | Storage |
| ESD Test | Air +/-10kV, Contact +/-6kV, Human body model (150pF, 330ohms), 9 points pane surface! | No operating |

Note 1) The test shall be executed under a condition where no condensation is formed.

Note 2) After the test, the display should be left at normal temperatures (15 - 35°C). Then the display should be inspected for normal operation.

Note 3) Should be no condensation.

Note 4) Except for the degradation of polarizer.

4.3.2 Judgment

(1) There shall be no abnormality in the functions and the display.

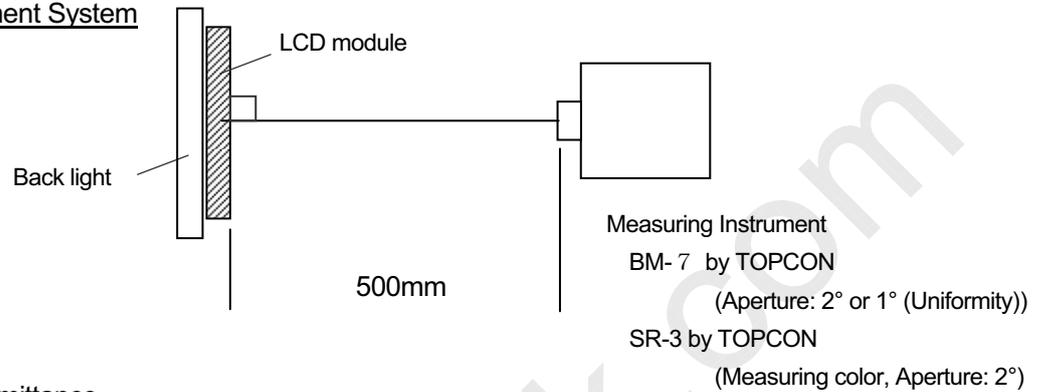
(2) Appearance and display quality should not have distinguished degradation.

5 Test Method

5.1 Optical Test Method

- Environment : Inside a dark room
- Measuring Instrument : Used as shown below
- Measurement point : Center of Active area unless otherwise specified
- Direction of measurement : Vertical direction at Active area unless otherwise specified

Measurement System



(1) Transmittance

Measure the luminance when white is displayed (gradation level L255), and measure the transmittance.

(2) Contrast Ratio

Measure the luminance when black is displayed (gradation level L0), and the luminance when white is displayed (gradation level L255), and then contrast CR should be obtained from the next expression:

$$CR = L255 / L0$$

(3) Viewing Angle

Measure the contrast ratio by the direction specified by the conditions under item 4.2.2.

(4) Displayed Color

Measure the displayed color of white raster (white: gradation level L255), red raster (red: gradation level L255), green raster (green: gradation level L255), blue raster (blue: gradation level L255), and measure each of the chromaticity coordinates: x_W , y_W , x_R , y_R , x_G , y_G , x_B , and y_B .

6 Others

6.1 Applicable Standard

No warranty that satisfies the standards as shown below will be offered from our company, with the LCD display incorporated into a system.

In addition, no warranty that satisfies the standards as shown below will be offered from our company for a stand-alone unit of the LCD display.

Should compliance to the standards as shown below be required for a system, it is requested that the required measures be taken on the system side.

a) Unwanted Radiation (example)

FCC : PARTS15 CLASS B
CISPR : CLASS B
VCCI : CLASSB

b) Safety Standard (example)

IEC 60950
UL 60950

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