



ASI-T-350ZA5SRN/AC

| ITEM | STANDARD VALUES | UNITS |
|-----------------------|-------------------------------------|-------|
| LCD type | 3.5" TFT | -- |
| Dot arrangement | 320(RGB) × 480 | dots |
| Color filter array | RGB vertical stripe | -- |
| Display mode | IPS / Transmissive / Normally Black | -- |
| Viewing Direction | 80/80/80/80 deg(U/D/L/R @ C/R>10) | -- |
| Driver IC | ST7796S | -- |
| Module size | 53.76(W) × 84.18(H) × 2.15(T) | mm |
| Active area | 48.96(W) × 73.44(H) | mm |
| Dot pitch | 0.153(W) × 0.153(H) | mm |
| Interface | SPI + 18-bit RGB interface | -- |
| Operating temperature | -10 ~ +60 | °C |
| Storage temperature | -20 ~ +70 | °C |
| Back Light | 8 White LED | -- |
| Weight | TBD | g |

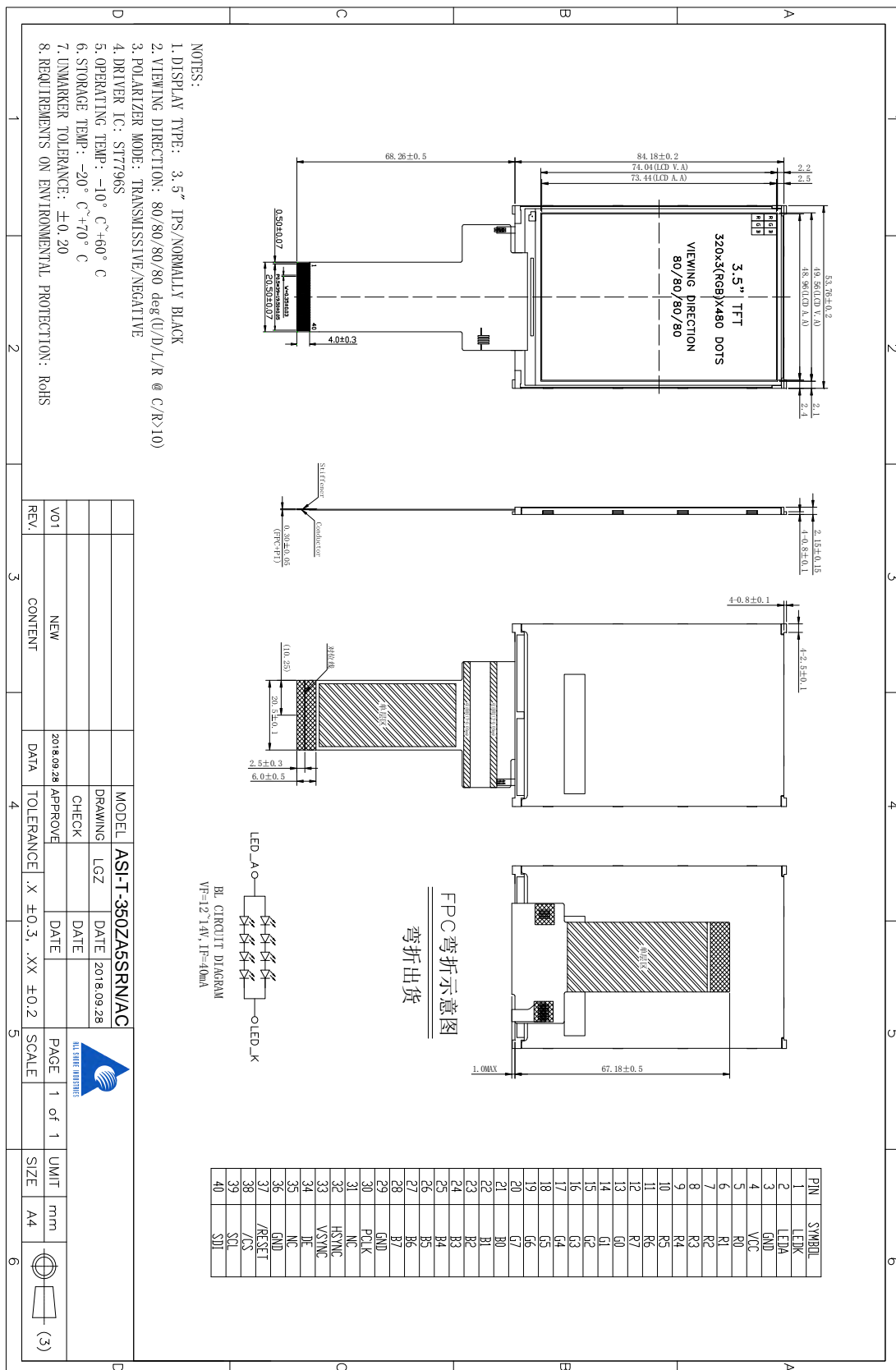
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2. General Information

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| Weight | TBD | g |

3. External Dimensions



4. Interface Description

| Pin | Symbol | Description. |
|-------|--------|---|
| 1 | VLED- | LED backlight (Cathode). |
| 2 | VLED+ | LED backlight (Anode). |
| 3 | GND | Ground. |
| 4 | VDD | Power supply. |
| 5~12 | R0~R7 | Red Data. |
| 13~20 | G0~G7 | Green Data. |
| 21~28 | B0~B7 | Blue Data. |
| 29 | GND | Ground. |
| 30 | PCLK | Dot clock signal input. Latching input data at its rising edge. |
| 31 | NC | NC. |
| 32 | HSYNC | Horizontal sync input. Negative polarity. |
| 33 | VSYSN | Vertical sync input. Negative polarity. |
| 34 | DE | Data enable input. Active high to enable the input data bus. |
| 35 | NC | NC. |
| 36 | GND | Ground. |
| 37 | /RESET | Reset input pin, Active "L". |
| 38 | /CS | Chip select input pin ("Low" enable) in MPU I/F and SPI I/F. |
| 39 | SCL | Serial Clock when operates in the serial interface |
| 40 | SDI | Serial input signal in SPI I/F. |

5. Absolute Maximum Ratings

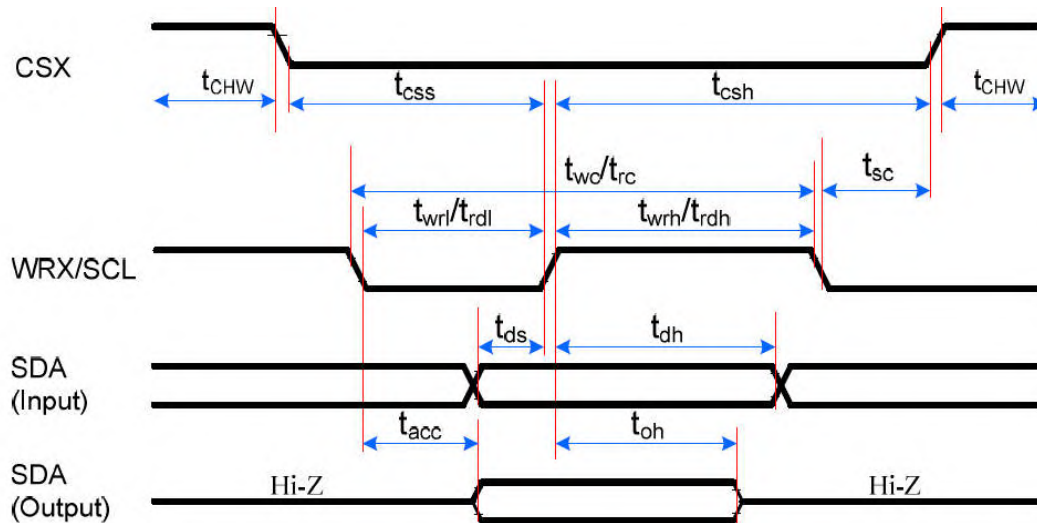
| Item | Symbol | Min. | Max. | Unit |
|-----------------------|-----------------|------|---------|------|
| Analog Supply Voltage | VCC | -0.3 | 3.3 | V |
| Input Voltage | V _{in} | -0.3 | VCC+0.3 | V |
| Operating Temperature | T _{OP} | -10 | 60 | °C |
| Storage Temperature | T _{ST} | -20 | 70 | °C |
| Storage Humidity | HD | 20 | 90 | %RH |

6. DC Characteristics

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-----------------------|-----------------|--------|------|--------|------|---------------------|
| Analog Supply Voltage | VCC | 2.65 | 2.8 | 3.3 | V | - |
| Input High Voltage | V _{IH} | 0.7VCC | - | VCC | V | Digital input pins |
| Input Low Voltage | V _{IL} | GND | - | 0.3VCC | V | Digital input pins |
| Output High Voltage | V _{OH} | 0.8VCC | - | VCC | V | Digital output pins |
| Output Low Voltage | V _{OL} | GND | - | 0.2VCC | V | Digital output pins |
| I/O Leak Current | I _{LI} | -1.0 | - | 1.0 | uA | - |

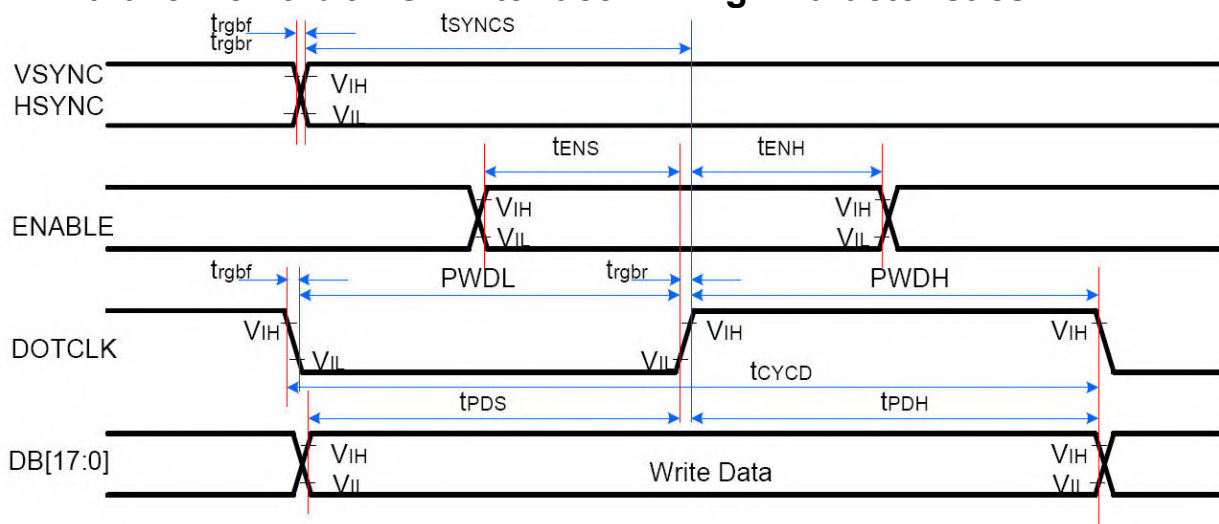
7. Timing Characteristics

7.1 Display Serial Interface Timing Characteristics (3-line SPI system)



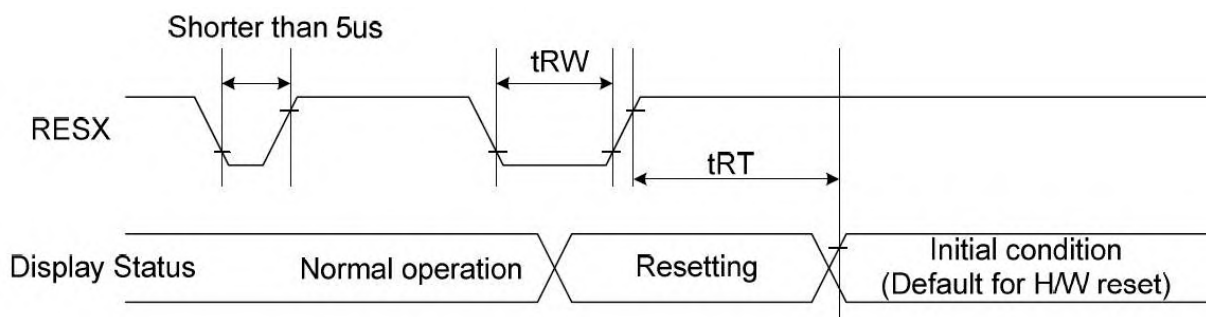
| Signal | Symbol | Parameter | min | max | Unit | Description |
|------------------|--------|------------------------------|-----|-----|------|---------------------|
| CSX | tsc | SCL-CSX | 15 | - | ns | |
| | tchwh | CSX H Pulse Width | 40 | - | ns | |
| | tcss | Chip select time (Write) | 60 | - | ns | |
| | tcsh | Chip select hold time (Read) | 65 | - | ns | |
| SCL | twc | Serial Clock Cycle (Write) | 66 | - | ns | |
| | twrh | SCL H Pulse Width (Write) | 15 | - | ns | |
| | twrl | SCL L Pulse Width (Write) | 15 | - | ns | |
| | trc | Serial Clock Cycle (Read) | 150 | - | ns | |
| | trdh | SCL H Pulse Width (Read) | 60 | - | ns | |
| | trdl | SCL L Pulse Width (Read) | 60 | - | ns | |
| SDA/SDI (Input) | tds | Data setup time (Write) | 10 | - | ns | |
| | tdh | Data hold time (Write) | 10 | - | ns | |
| SDA/SDO (Output) | tacc | Access time (Read) | 10 | 50 | ns | For maximum CL=30pF |
| | toh | Output disable time (Read) | 15 | 50 | ns | For minimum CL=8pF |

7.2 Parallel 18/16-bit RGB Interface Timing Characteristics



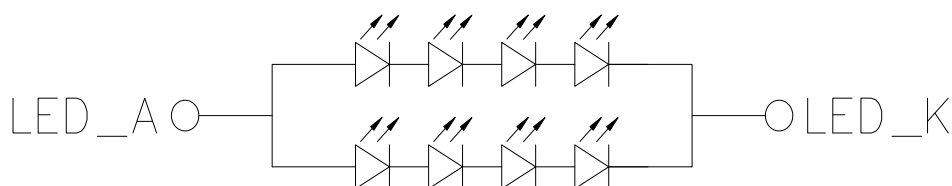
| Signal | Symbol | Parameter | min | max | Unit | Description |
|-----------------|----------------------|-----------------------------------|-----|-----|------|--|
| VSYNC/ HSYNC | t_{SYNCS} | VSYNC/HSYNC setup time | 15 | - | ns | 16-/18-/24-bit bus RGB interface mode |
| | t_{SYNCH} | VSYNC/HSYNC hold time | 15 | - | ns | |
| ENABLE | t_{ENS} | ENABLE setup time | 15 | - | ns | |
| | t_{ENH} | ENABLE hold time | 15 | - | ns | |
| DB [23:0] | t_{POS} | Data setup time | 15 | - | ns | |
| | t_{PDH} | Data hold time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK high-level period | 20 | - | ns | |
| | PWDL | DOTCLK low-level period | 20 | - | ns | |
| | t_{CYCD} | DOTCLK cycle time | 50 | - | ns | |
| | t_{rgbr}, t_{rgbf} | DOTCLK,HSYNC,VSYNC rise/fall time | - | 15 | ns | |

7.3 Reset Timing Characteristics



| Signal | Symbol | Parameter | Min | Max | Unit |
|--------|----------|----------------------|-----|----------------------------------|------|
| RESX | t_{RW} | Reset pulse duration | 10 | | uS |
| | t_{RT} | Reset cancel | | 5 (note 1,5) 120 (note 1,6,7) | mS |

8. Backlight Characteristics



| Item | Symbol | MIN | TYP | MAX | UNIT | Test Condition |
|----------------------------|--------|-------|------|-----|-------------------|----------------|
| Supply Voltage | V_f | 11.6 | 12.8 | 14 | V | $I_f=40mA$ |
| Supply Current | I_f | - | 40 | - | mA | - |
| Luminous Intensity for LCM | - | 500 | 550 | - | Cd/m ² | $I_f=40mA$ |
| Life Time | - | 20000 | - | - | Hr | $I_f=40mA$ |
| Backlight Color | White | | | | | |

9. Optical Characteristics

| Item | | Symbol | Conditions | Specifications (typ) | Unit | Note |
|----------------------|-------|-----------|---|----------------------|------|--|
| Transmittance | | T% | Viewing normal angle $q_X = q_Y = 0^\circ$ | 4.3 | % | All left side data are based on INX's following condition – 1.CG : NTSC 69% 2.AR : 67.5% 3.Light Source : INX LED BLU 4.Machine : DMS 803 5. Vwhite > 5.0 V, Vdark < 0.3V 6. Polarizer : NPF-TEGQ1465DUHC |
| Contrast Ratio | | CR | | 700 | -- | |
| Response Time | | Ton+ Toff | | 30 | ms | |
| Viewing Angle | Hor. | q_{X+} | Center CR>10 | 80 | deg. | Under C light Simulation |
| | | q_{X-} | | 80 | | |
| | Ver. | q_{Y+} | | 80 | | |
| | | q_{Y-} | | 80 | | |
| CF only Chromaticity | Red | X_R | Viewing normal angle $q_X = q_Y = 0^\circ$ | 0.660 | -- | |
| | | Y_R | | 0.325 | -- | |
| | Green | X_G | | 0.277 | -- | |
| | | Y_G | | 0.568 | -- | |
| | Blue | X_B | | 0.145 | -- | |
| | | Y_B | | 0.072 | -- | |
| | White | X_W | | 0.309 | -- | |
| | | Y_W | | 0.332 | -- | |

*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

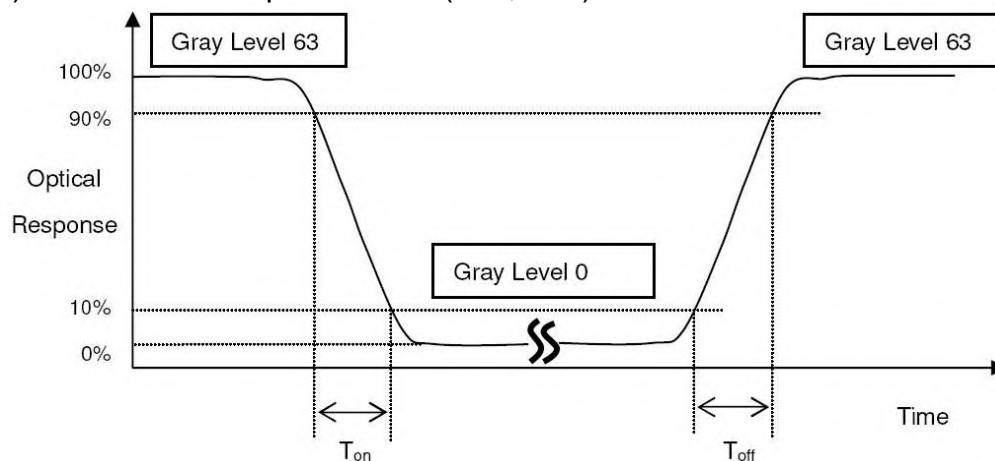
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

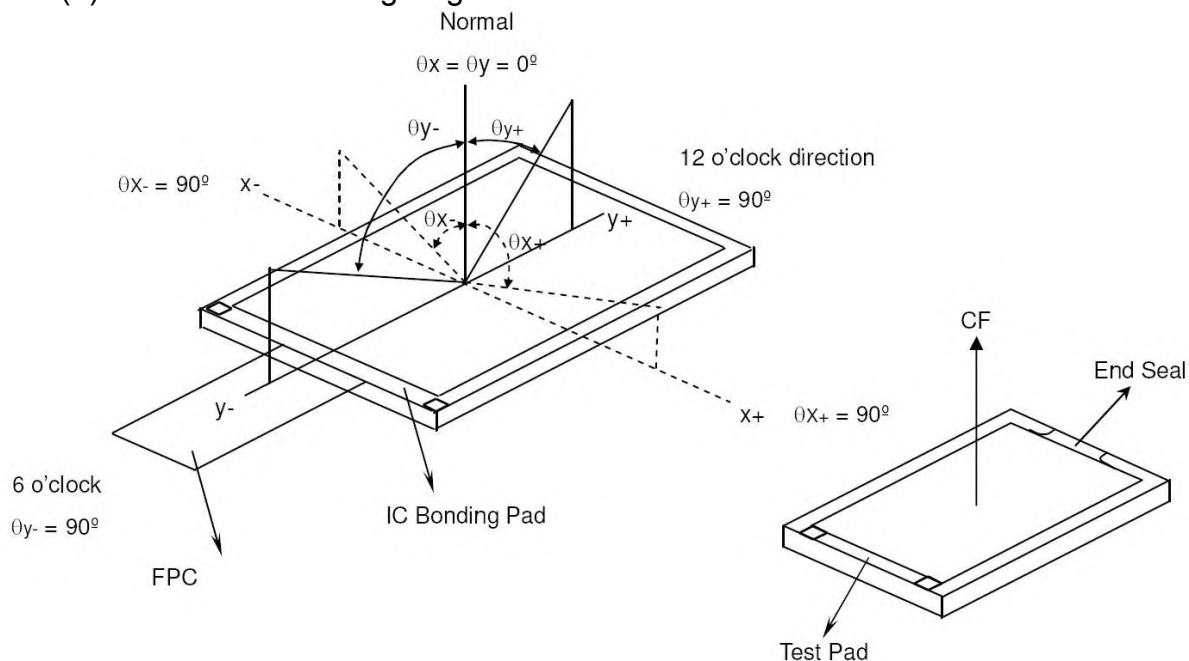
$$CR = CR(5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

*Note (2) Definition of Response Time (Ton, Toff):

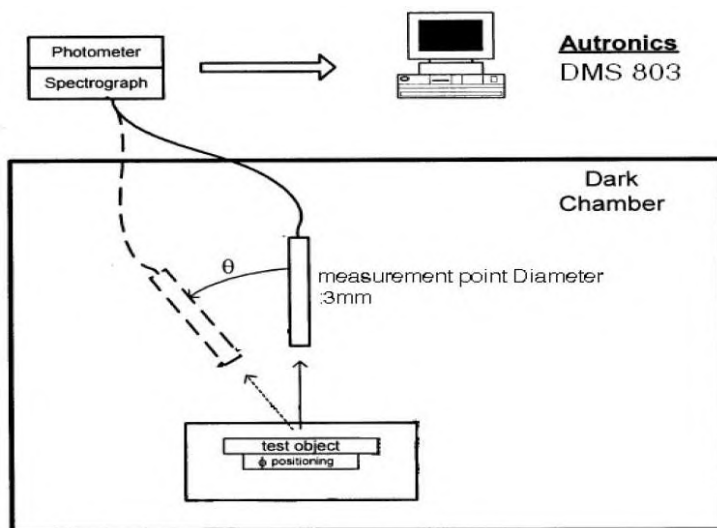


***Note(3) Definition of Viewing Angle**



***Note (4) Measurement Set-Up:**

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



10. Reliability Test Conditions And Methods

| NO. | TEST ITEMS | TEST CONDITION | INSPECTION AFTER TEST |
|-----|----------------------------|---|--|
| ① | High Temperature Storage | 70°C±2°C×96Hours | Inspection after 2~4hours storage at room temperature,the samples should be free from defects: 1,Air bubble in the LCD. 2,Sealleak. 3,Non-display. 4,Missing segments. 5,Glass crack. 6,Current IDD is twice higher than initial value. 7,The surface shall be free from damage. 8,The electric charateristic requirements shall be satisfied. |
| ② | Low Temperature Storage | -20°C±2°C×96Hours | |
| ③ | High Temperature Operating | 60°C±2°C×96Hours | |
| ④ | Low Temperature Operating | -10°C±2°C×96Hours | |
| ⑤ | Temperature Cycle(Storage) | -10°C ↔ 25°C ↔ 60°C (30min) (5min) (30min) 1cycle Total 10cycle | |
| ⑥ | Damp Proof Test (Storage) | 50°C±5°C×90%RH×96Hours | |
| ⑦ | Vibration Test | Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition) | |
| ⑧ | Drooping Test | Drop to the ground from 1M height one time every side of carton. (Packing Condition) | |
| ⑨ | ESD Test | Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times | |

REMARK:

- 1,The Test samples should be applied to only one test item.
- 2,Sample side for each test item is 5~10pcs.
- 3,For Damp Proof Test,Pure water(Resistance > 10MΩ)should be used.
- 4,In case of malfunction defect caused by ESD damage,if it would be recovered to normal state after resetting,it would be judge as a good part.
- 5,EL evaluation should be excepted from reliability test with humidity and temperature:Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- 6,Failure Judgment Criterion:Basic Specification Electrical Characteristic,Mechanical Characteristic,Optical Characteristic.

11. Inspection Standard

This standard apply to C-STN/TFT module

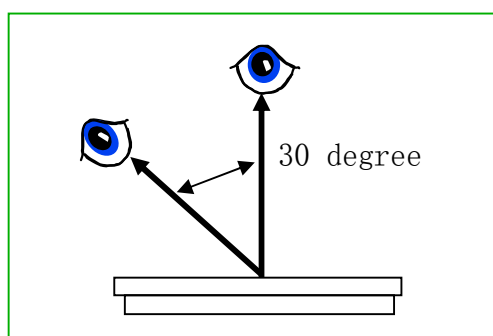
1. Spot check plan:

According to spot check level II ,MIL-STD-105D Level II ,the rank of accept or reject is below:

3A 级、2A 级: major non-conformance: AQL 0.25 minor non-conformance: AQL 0.4

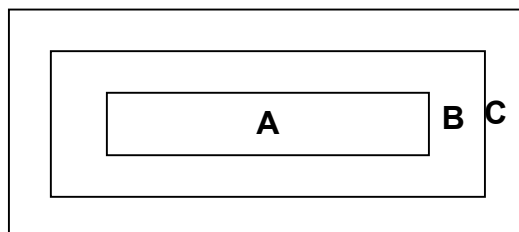
A 级: major non-conformance: AQL 0.65 minor non-conformance: AQL 1.

2. Inspection condition:



Under daylight lamp 20~40W, product distance inspector'eye 30cm,incline degree 30°.

3. LCD area define:



Area A: display area

Area B: VA area

Area C: out of VA area,not in sight after assembly

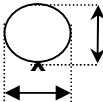
Remark :non-conformance at area C,but is OK that isn't influence reliability of product & assembly by customer.

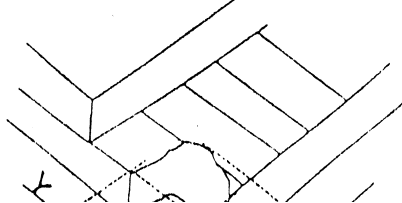
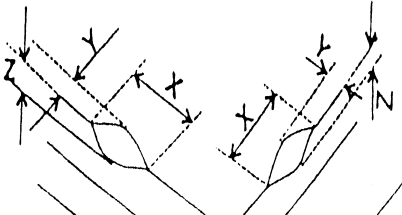
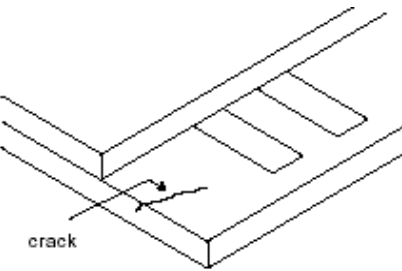
4. Inspection standard

4.1 Major non-conformance

| NO. | Item | Inspection standard | Rate |
|-------|--------------------------|--|-------|
| 4.1.1 | Function non-conformance | 1) No display, display abnormaly 2) Miss line, short 3) B/L no function or function abnormaly 4) TP no function | major |
| 4.1.2 | miss | No matter miss what component | |
| 4.1.3 | Out of size | Module dimension out of spec | |

4.2 Appearance non-conformance

| NO. | Item | Inspection standard | Rate | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------|--------------------------------|--|----------------------|--------------------------------------|-------------------|--------|--|-----------|----------|---|------------------|--------|--------|---------------|-------------------------|---|--------|-------------------------|----------------------|---|-------------------------|--------------|----------------------|---------------|---|--|------------|--------------------------------|--|-------|
| 4.2.1 | Black or white spot (power on) | <div> <div>dot non-conformance define Φ</div> <div> $\Phi = \frac{(x + y)}{2}$  </div> </div> | Minor | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <div>A grade</div> <table> <tr> <th rowspan="2"> <div>area</div> <div>size (mm)</div> </th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> <tr> <td>$\Phi \leq 0.10$</td> <td colspan="2">ignore</td> <td rowspan="5">ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.15$</td> <td colspan="2">3</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td colspan="2">2</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.25$</td> <td colspan="2">1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td colspan="2">0</td> </tr> </table> | | <div>area</div> <div>size (mm)</div> | Most approve q'ty | | | A | B | C | $\Phi \leq 0.10$ | ignore | | ignore | $0.10 < \Phi \leq 0.15$ | 3 | | $0.15 < \Phi \leq 0.20$ | 2 | | $0.20 < \Phi \leq 0.25$ | 1 | | $0.25 < \Phi$ | 0 | | | | | |
| | | <div>area</div> <div>size (mm)</div> | | | Most approve q'ty | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $\Phi \leq 0.10$ | | ignore | | ignore | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $0.10 < \Phi \leq 0.15$ | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $0.15 < \Phi \leq 0.20$ | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $0.20 < \Phi \leq 0.25$ | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $0.25 < \Phi$ | | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Most approve 4 damages, dot to dot $\geq 10\text{mm}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.2.2 | Black or white line (power on) | <div>A grade</div> <table> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>L(length)</th> <th>W(width)</th> <th>A</th> <th>B</th> <th>C</th> </tr> <tr> <td>ignore</td> <td>$W \leq 0.03$</td> <td colspan="2">ignore</td> <td rowspan="5">ignore</td> </tr> <tr> <td>$L \leq 5.0$</td> <td>$0.03 < W \leq 0.05$</td> <td colspan="2">2</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.05 < W \leq 0.07$</td> <td colspan="2">1</td> </tr> <tr> <td></td> <td>$0.07 < W$</td> <td colspan="2">Treat with dot non-conformance</td> </tr> </table> | Size(mm) | | Most approve q'ty | | | L(length) | W(width) | A | B | C | ignore | $W \leq 0.03$ | ignore | | ignore | $L \leq 5.0$ | $0.03 < W \leq 0.05$ | 2 | | $L \leq 3.0$ | $0.05 < W \leq 0.07$ | 1 | | | $0.07 < W$ | Treat with dot non-conformance | | Minor |
| | | Size(mm) | | Most approve q'ty | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | L(length) | W(width) | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ignore | $W \leq 0.03$ | ignore | | ignore | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $L \leq 5.0$ | $0.03 < W \leq 0.05$ | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | $L \leq 3.0$ | $0.05 < W \leq 0.07$ | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $0.07 < W$ | Treat with dot non-conformance | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Most approve 3 damages, line to line $\geq 10\text{mm}$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 4.2.3 | Polarizer position | 1) polarizer attach meet drawing,disallow out of LCD. 2) polarizer must cover display area（special require unless） | Minor | | | | | | | | | | | | | |
|-------|-----------------------|---|-------|---|---|------|----|--------|---|---|---|------|-------------|--------|-------|--|
| 4.2.4 | LCD non-conformance | <div><div>(i) crash at side（remark: S=ITO length）</div><div><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0</td><td>≤S</td><td>ignore</td></tr></table><div>Crash disallow extend to ITO or seal.</div></div><div><div>(ii) commonly surface scathe</div><div><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤2.0</td><td><frame edge</td><td>ignore</td></tr></table></div></div><div><div>(iii) crack</div><div>Disallow extend crack</div><div><div>crack</div></div></div></div> <td>Minor</td> <td></td> | X | Y | Z | ≤3.0 | ≤S | ignore | X | Y | Z | ≤2.0 | <frame edge | ignore | Minor | |
| X | Y | Z | | | | | | | | | | | | | | |
| ≤3.0 | ≤S | ignore | | | | | | | | | | | | | | |
| X | Y | Z | | | | | | | | | | | | | | |
| ≤2.0 | <frame edge | ignore | | | | | | | | | | | | | | |
| 4.2.5 | Contrast voltage warp | VOP/Vlcd voltage of confirmed sample±0.15V | Minor | | | | | | | | | | | | | |
| 4.2.6 | color | Color & luminance of module scope reference spec | Minor | | | | | | | | | | | | | |
| 4.2.7 | Cross talk | Reference confirmed limit sample | Minor | | | | | | | | | | | | | |

12. Handling Precautions

12.1 Mounting method

The LCD panel of LCD module consists of two thin glass plates with polarizes which can easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl), Sulfur (S)

If goods were sent without being silicic acid coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

12.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

12.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

12.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required.

12.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
[It is recommended to store them as they have been contained in the inner container at the time of delivery from us

12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

13. Precaution For Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to ASI LCD , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

14. Packing Method

