

# Specification for Approval

Customer: \_\_\_\_\_

Model Name: \_\_\_\_\_

| Supplier Approval |              |             | Customer approval |
|-------------------|--------------|-------------|-------------------|
| R&D Designed      | R&D Approved | QC Approved |                   |
| <i>Peter</i>      | Peng Jun     |             |                   |



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## 1. Scope

This specification defines general provisions as well as inspection standards for TFT module supplied by AMSON electronics.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution

## 2. General Information

| ITEM                  | STANDARD VALUES               | UNITS |
|-----------------------|-------------------------------|-------|
| LCD type              | 3.5" TFT                      | --    |
| Dot arrangement       | 240(RGB) × 320                | dots  |
| Top Polarizer Type    | Anti-Glare                    | --    |
| Display mode          | TFT/ Transflective            | --    |
| Viewing Direction     | 6 O'clock                     | --    |
| Driver IC             | ILI9341V                      | --    |
| Module size           | 61.00(W) × 85.00(H) × 2.93(T) | mm    |
| Active area           | 53.64(W) × 71.52(H)           | mm    |
| Dot pitch             | 0.2235(W) × 0.2235(H)         | mm    |
| Interface             | SPI+18BIT RGB                 | --    |
| Operating temperature | -20 ~ +70                     | °C    |
| Storage temperature   | -30 ~ +80                     | °C    |
| Back Light            | 6 White LED                   | --    |
| Weight                | TBD                           | g     |

## 3. External Dimensions

**NOTES:**

- 1.DISPLAY TYPE: 3.5" TFT
- 2.VIEWING DIRECTION: 6 O'CLOCK
- 3.LCD DRIVE IC: ILI9341V
- 4.POLARIZER MODE: TRANSFLECTIVE/POSITIVE
- 5.OPERATING TEMP.: -20° C~+70° C
- 6.STORAGE TEMP.: -30° C~+80° C
- 7.INTERFACE: SPI+18 bit RGB
- 8.SURFACE LUMINANCE: 150 cd/m2(TYP.)
- 9.UNMARKER TOLERANCE: ± 0.20
- 10.REQUIREMENTS ON ENVIRONMENTAL PROTECTION: ROHS

View Direction  
6 o'clock

250Wx235H

LED CIRCUIT DIAGRAM  
19.2V@20mA

Pixel Detail

| NO. | DESCRIPTION OF REVISION | REASON | REVISED BY | DATE     |
|-----|-------------------------|--------|------------|----------|
| 1   | first issue             | 0      |            | 2016/3/2 |

|    |       |    |       |
|----|-------|----|-------|
| 1  | VL1   | 26 | B1    |
| 2  | GND   | 27 | B0    |
| 3  | VL2   | 28 | ENAB  |
| 4  | GND   | 29 | GND   |
| 5  | VSHD  | 30 | HSYNC |
| 6  | GND   | 31 | GND   |
| 7  | GND   | 32 | CLK   |
| 8  | GND   | 33 | GND   |
| 9  | VSYNC | 34 | G5    |
| 10 | GND   | 35 | G4    |
| 11 | RESET | 36 | G3    |
| 12 | GND   | 37 | G2    |
| 13 | GND   | 38 | G1    |
| 14 | GND   | 39 | G0    |
| 15 | CS    | 40 | GND   |
| 16 | GND   | 41 | R5    |
| 17 | SDO   | 42 | R4    |
| 18 | SDI   | 43 | R3    |
| 19 | GND   | 44 | R2    |
| 20 | SCL   | 45 | R1    |
| 21 | GND   | 46 | R0    |
| 22 | B5    | 47 | GND   |
| 23 | B4    | 48 | GND   |
| 24 | B3    | 49 | GND   |
| 25 | B2    | 50 | GND   |

YU DU AMSON ELECTRONICS Co., Ltd.

YU DU AMSON 電子有限公司

| TITLE OUTLINE DIMENSION |                     | UNIT             |  |
|-------------------------|---------------------|------------------|--|
| DRAWN BY:               | D/N: AM-240320-035D | mm               |  |
| CHECKED BY:             | Rev: 0              | mm               |  |
| APPROVED BY:            | SCALE: 1:1          | SHEET NO. 1 OF 1 |  |

## 4. Interface Description

| PIN NO. | PIN NAME | DESCRIPTION                        |
|---------|----------|------------------------------------|
| 1       | VL1      | Anode of LED(High voltage)         |
| 2       | GND      | Power ground                       |
| 3       | VL2      | Cathode of LED(Low voltage)        |
| 4       | GND      | Power ground                       |
| 5       | VSHD     | Power supply for digital           |
| 6-8     | GND      | Power ground                       |
| 9       | VSYNC    | Vertical sync. in RGB mode         |
| 10      | GND      | Power ground                       |
| 11      | RESET    | Reset(Low active)                  |
| 12-14   | GND      | Power ground                       |
| 15      | CS       | Chip select input(Low enable)      |
| 16      | GND      | Power ground                       |
| 17      | SDO      | Serial data output                 |
| 18      | SDI      | Serial data input                  |
| 19      | GND      | Power ground                       |
| 20      | SCL      | Serial interface clock             |
| 21      | GND      | Power ground                       |
| 22-27   | B5~B0    | Blue data bus                      |
| 28      | ENAB     | Display enable pin from controller |
| 29      | GND      | Power ground                       |
| 30      | HSYNC    | Horizontal sync. in RGB mode       |
| 31      | GND      | Power ground                       |
| 32      | DCLK     | Pixel clock signal in RGB mode     |
| 33      | GND      | Power ground                       |
| 34-39   | G5~G0    | Green data bus                     |
| 40      | GND      | Power ground                       |
| 41-46   | R5~R0    | Red data bus                       |
| 47-50   | GND      | Power ground                       |

## 5. Absolute Maximum Ratings

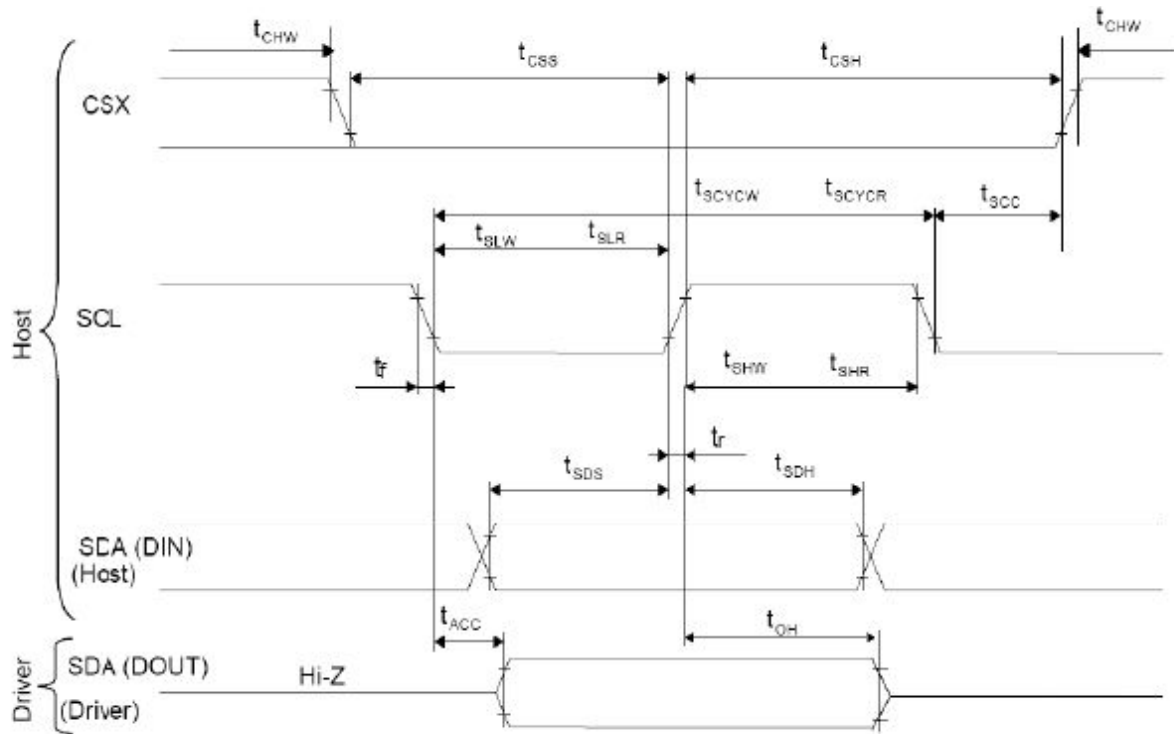
| Item                     | Symbol           | Min. | Max. | Unit |
|--------------------------|------------------|------|------|------|
| Logic Supply Voltage     | VSHD             | -0.3 | 4.5  | V    |
| Analog Supply Voltage    | VSHD             | -0.3 | 4.5  | V    |
| Supply current (One LED) | I <sub>LED</sub> |      | 30   | mA   |
| Operating Temperature    | T <sub>OP</sub>  | -20  | 70   | °C   |
| Storage Temperature      | T <sub>ST</sub>  | -30  | 80   | °C   |
| Storage Humidity         | HD               | 20   | 90   | %RH  |

## 6. DC Characteristics

| Item                  | Symbol          | Min.     | Typ. | Max.     | Unit | Remark |
|-----------------------|-----------------|----------|------|----------|------|--------|
| Logic Supply Voltage  | VSHD            | 3.0      | 3.3  | 3.6      | V    | -      |
| Analog Supply Voltage | VSHD            | 3.0      | 3.3  | 3.6      | V    | -      |
| Input High Voltage    | V <sub>IH</sub> | 0.7 VSHD | -    | VSHD     | V    | -      |
| Input Low Voltage     | V <sub>IL</sub> | GND      | -    | 0.3 VSHD | V    | -      |
| I/O Leak Current      | I <sub>LI</sub> | -1       | -    | 1        | uA   | -      |

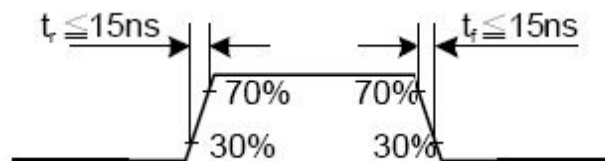
## 7. Timing Characteristics

### 7.1 3-WIRES SPI Timing Diagram



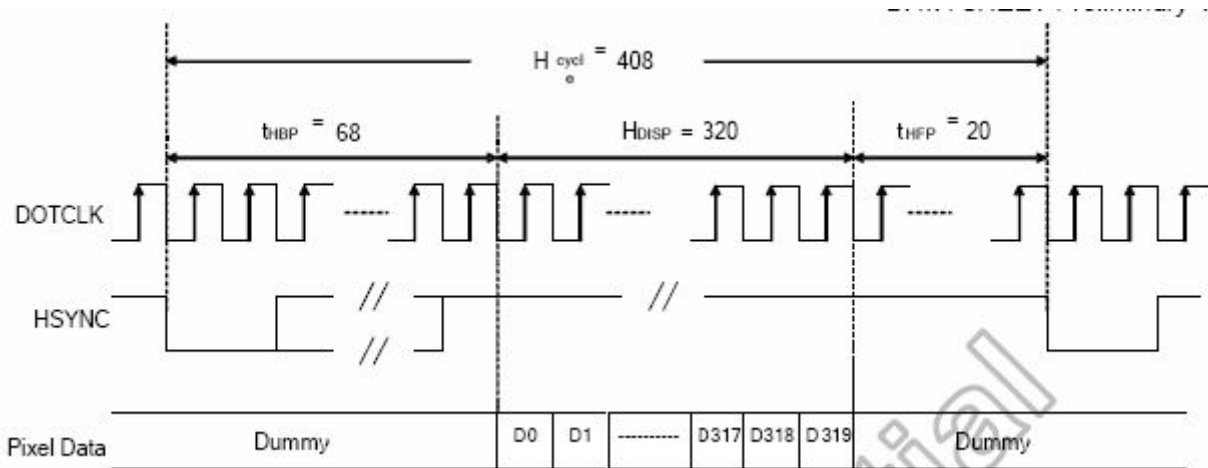
| Signal             | Symbol | Parameter                   | min | max | Unit | Description |
|--------------------|--------|-----------------------------|-----|-----|------|-------------|
| SCL                | tscycw | Serial Clock Cycle (Write)  | 100 | -   | ns   |             |
|                    | tshw   | SCL "H" Pulse Width (Write) | 40  | -   | ns   |             |
|                    | tslw   | SCL "L" Pulse Width (Write) | 40  | -   | ns   |             |
|                    | tscycr | Serial Clock Cycle (Read)   | 150 | -   | ns   |             |
|                    | tshr   | SCL "H" Pulse Width (Read)  | 60  | -   | ns   |             |
|                    | tslr   | SCL "L" Pulse Width (Read)  | 60  | -   | ns   |             |
| SDA / SDI (Input)  | tsds   | Data setup time (Write)     | 30  | -   | ns   |             |
|                    | tsdh   | Data hold time (Write)      | 30  | -   | ns   |             |
| SDA / SDO (Output) | tacc   | Access time (Read)          | 10  | -   | ns   |             |
|                    | toh    | Output disable time (Read)  | 10  | 50  | ns   |             |
| CSX                | tsc    | SCL-CSX                     | 20  | -   | ns   |             |
|                    | tch    | CSX "H" Pulse Width         | 40  | -   | ns   |             |
|                    | tcs    | CSX-SCL Time                | 60  | -   | ns   |             |
|                    | tcs    |                             | 65  | -   | ns   |             |

Note:  $T_a = 25^\circ\text{C}$ ,  $V_{DDI} = 1.65\text{V to } 3.3\text{V}$ ,  $V_{CI} = 2.5\text{V to } 3.3\text{V}$ ,  $AGND = VSS = 0\text{V}$

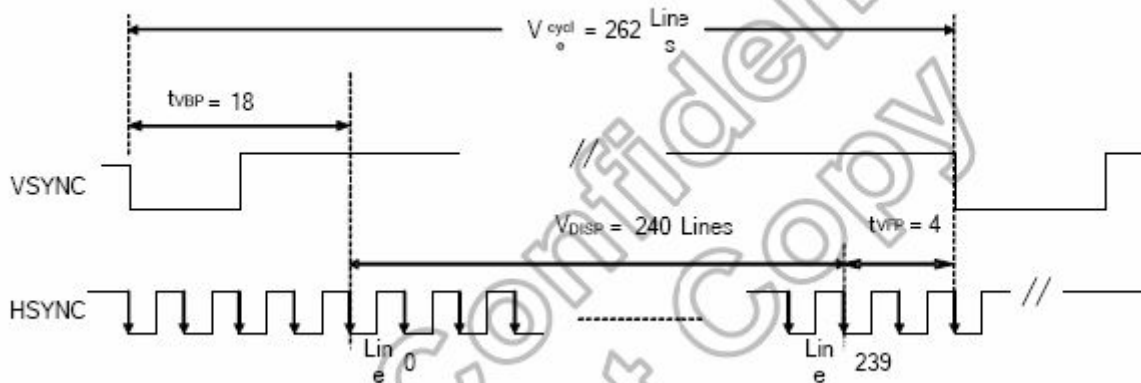




## 7.2 RGB Timing Diagram



(a) Horizontal Data Transaction Timing



(b) Vertical Data Transaction Timing

| Characteristics              | Symbol      | Min.   |       | Typ.        |       | Max.   |       | Unit    |
|------------------------------|-------------|--------|-------|-------------|-------|--------|-------|---------|
|                              |             | 24 bit | 8 bit | 24 bit      | 8 bit | 24 bit | 8 bit |         |
| DOTCLK Frequency             | fDOTCLK     | -      | -     | 6.5         | 19.5  | 10     | 30    | MHz     |
| DOTCLK Period                | tDOTCLK     | 100    | 33.3  | 154         | 51.3  | -      | -     | ns      |
| Horizontal Frequency (Line)  | fH          | -      | -     | 14.9        |       | 22.35  |       | KHz     |
| Vertical Frequency (Refresh) | fV          | -      | -     | 60          |       | 90     |       | Hz      |
| Horizontal Back Porch        | tHBP        | -      | -     | 68          | 204   | -      | -     | tDOTCLK |
| Horizontal Front Porch       | tHFP        | -      | -     | 20          | 60    | -      | -     | tDOTCLK |
| Horizontal Data Start Point  | tHBP        | -      | -     | 68          | 204   | -      | -     | tDOTCLK |
| Horizontal Blanking Period   | tHBP + tHFP | -      | -     | 88          | 264   | -      | -     | tDOTCLK |
| Horizontal Display Area      | HDISP       | -      | -     | 320         | 960   | -      | -     | tDOTCLK |
| Horizontal Cycle             | Hcycle      | -      | -     | 408         | 1224  | 450    | 1350  | tDOTCLK |
| Vertical Back Porch          | tvBP        | -      | -     | 18          |       | -      | -     | Lines   |
| Vertical Front Porch         | tvFP        | -      | -     | 4           |       | -      | -     | Lines   |
| Vertical Data Start Point    | tvBP        | -      | -     | 18          |       | -      | -     | Lines   |
| Vertical Blanking Period     | tvBP + tvFP | -      | -     | 22          |       | -      | -     | Lines   |
| Vertical Display Area        | NTSC        | -      |       | 240         |       | -      |       | Lines   |
|                              | PAL         |        |       | 280(PALM=0) |       |        |       |         |
|                              | PAL         |        |       | 288(PALM=1) |       |        |       |         |
| Vertical Cycle               | NTSC        | -      |       | 262         |       | 350    |       | Lines   |
|                              | PAL         |        |       | 313         |       |        |       |         |

### 8. Backlight Characteristic

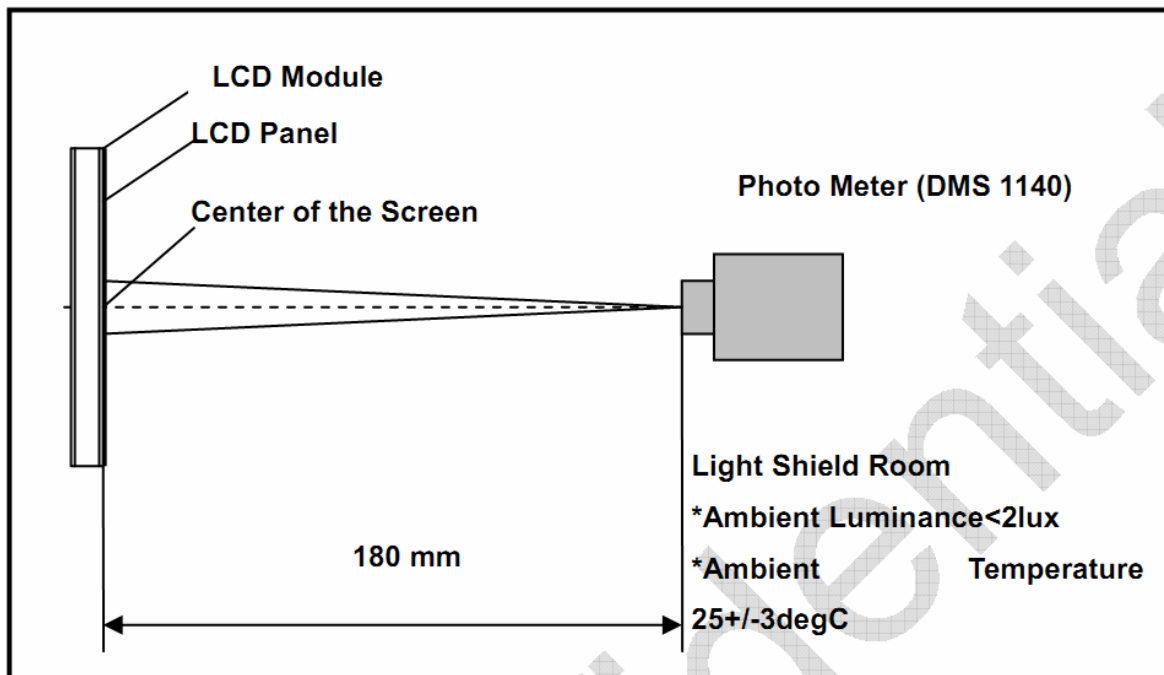


| Item                       | Symbol | MIN   | TYP   | MAX | UNIT              | Test Condition |
|----------------------------|--------|-------|-------|-----|-------------------|----------------|
| Supply Voltage             | Vf     | -     | 19.2  | -   | V                 | If=20mA        |
| Supply Current             | If     | -     | 20    | 30  | mA                | -              |
| Luminous Intensity for LCM | -      | -     | 150   | -   | Cd/m <sup>2</sup> | If=20mA        |
| Uniformity for LCM         | -      | 80    | -     | -   | %                 | If=20mA        |
| Life Time                  | -      | 30000 | 50000 | -   | Hr                | If=20mA        |
| Backlight Color            | White  |       |       |     |                   |                |

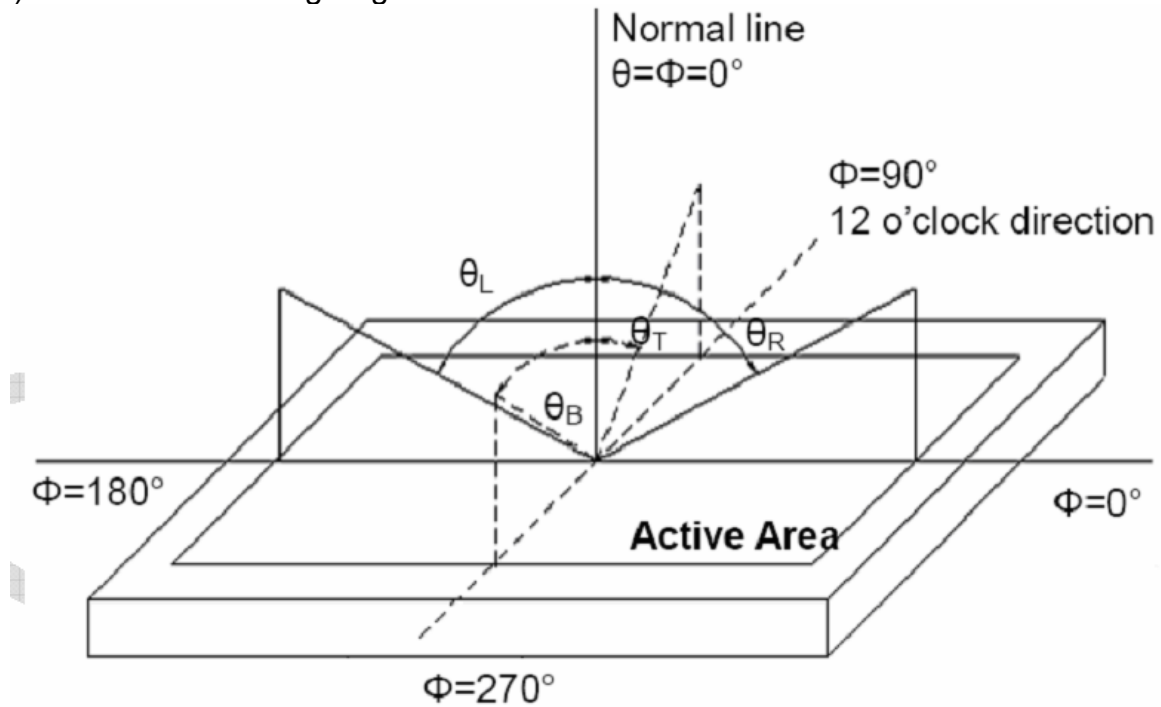
## 9. Optical Characteristics

| Item                               | Conditions | Min.       | Typ. | Max. | Unit | Note        |             |
|------------------------------------|------------|------------|------|------|------|-------------|-------------|
| Viewing Angle<br>(CR>10)           | Horizontal | $\theta_L$ | -    | 40   | -    | degree      | (1),(2),(6) |
|                                    |            | $\theta_R$ | -    | 45   | -    |             |             |
|                                    | Vertical   | $\theta_T$ | -    | 40   | -    |             |             |
|                                    |            | $\theta_B$ | -    | 55   | -    |             |             |
| Contrast Ratio                     | Center     | 100        | 150  | -    | -    | (1),(3),(6) |             |
| Response Time                      | Rising     | -          | 35   | -    | ms   | (1),(4),(6) |             |
|                                    | Falling    | -          | 35   | -    | ms   | 1),(4),(6)  |             |
| CF Color Chromaticity<br>(CIE1931) | Red x      | -          | -    | -    | -    | (1), (6)    |             |
|                                    | Red y      | -          | -    | -    | -    |             |             |
|                                    | Green x    | -          | -    | -    | -    |             |             |
|                                    | Green y    | -          | -    | -    | -    |             |             |
|                                    | Blue x     | -          | -    | -    | -    |             |             |
|                                    | Blue y     | -          | -    | -    | -    |             |             |
|                                    | White x    | -          | 0.31 | -    | -    |             |             |
| White y                            | -          | 0.32       | -    | -    |      |             |             |
| Transmittance                      |            | -          | -    | -    | %    | (1),(6)     |             |

Note (1) Measurement Setup: The LCD module should be stabilized at given temp. 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.



Note (2) Definition of Viewing Angle



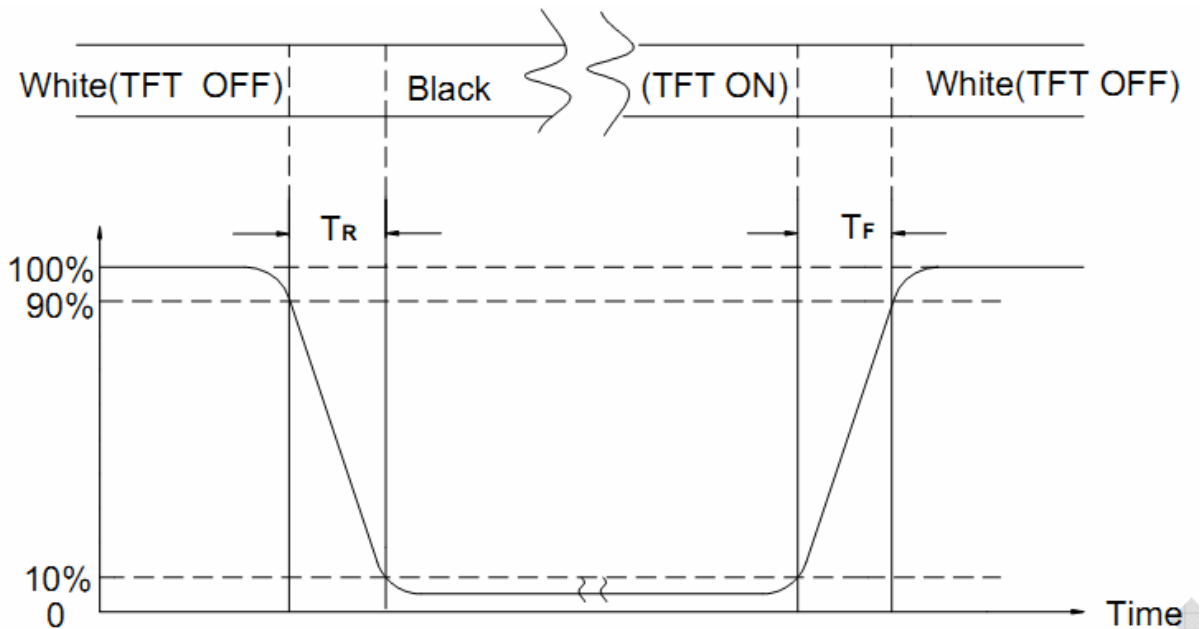
Note (3) Definition Of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

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

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition of response time



Note (5) Definition of Transmittance (Module is without signal input)

$$\text{Transmittance} = \text{Center Luminance of LCD} / \text{Center Luminance of Back Light} \times 100\%$$

Note (6) Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD

## 10. Reliability Test Conditions and Methods

| NO. | TEST ITEMS                 | TEST CONDITION                                                                                        | INSPECTION AFTER TEST                                                                                                                                                                                                                                                                                                                                                             |
|-----|----------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①   | High Temperature Storage   | 80°C±2°C×120Hours                                                                                     | Inspection after 2~4hours storage at room temperature, the samples should be free from defects:<br>1, Air bubble in the LCD.<br>2, Seal leak.<br>3, Non-display.<br>4, Missing segments.<br>5, Glass crack.<br>6, Current IDD is twice higher than initial value.<br>7, The surface shall be free from damage.<br>8, The electric characteristic requirements shall be satisfied. |
| ②   | Low Temperature Storage    | -30°C±2°C×120Hours                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                   |
| ③   | High Temperature Operating | 70°C±2°C×120Hours                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                   |
| ④   | Low Temperature Operating  | -20°C±2°C×120Hours                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                   |
| ⑤   | Temperature Cycle(Storage) | -20°C ↔ 25°C ↔ 70°C<br>(30min)    (5min)    (30min)<br>←—————→<br>1cycle<br>Total 10cycle             |                                                                                                                                                                                                                                                                                                                                                                                   |
| ⑥   | Damp Proof Test (Storage)  | 50°C±5°C×90%RH×120Hours                                                                               |                                                                                                                                                                                                                                                                                                                                                                                   |
| ⑦   | Vibration Test             | Frequency:10Hz~55Hz~10Hz<br>Amplitude:1.5M<br>X,Y,Z direction for total 3hours<br>(Packing Condition) |                                                                                                                                                                                                                                                                                                                                                                                   |
| ⑧   | Drooping Test              | Drop to the ground from 1M height<br>one time<br>every side of carton.<br>(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 accepted 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. Handling Precautions

### 11.1 Mounting method

The LCD panel of AMSON TFT module consists of two thin glass plates with polarizers which 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.

### 11.2 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 silicicon 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.

### 11.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

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

### 11.4 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

### 11.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit cause 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.
- 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.

### 11.6 storing

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

### 11.7 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

## 12. Precaution for Use

### 12.1

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.

### 12.2

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 AMSON TFT , 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.

## 13. Packing Method

TBD