

Specification for Approval

Customer: _____

Model Name: _____

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

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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

LCM

| TITEM | STANDARD VALUES | UNITS |
|--------------------------------|-----------------------------------|-------|
| LCD type | 3.5" TFT | -- |
| Dot arrangement | 480(RGB)×640 | dots |
| Color filter array | RGB vertical stripe | -- |
| Display mode | Transflective / Normally Black | - |
| Gray Scale Inversion Direction | 80/80/80/80 deg(U/D/L/R @ C/R>10) | -- |
| Eyes Viewing Direction | ALL | |
| Driver IC | HX8363A | -- |
| Module size | 66.10(W)×88.90(H)×5.13(T) | mm |
| Active area | 53.568(W)×71.424(H) | mm |
| Dot pitch | 0.116(W)×0.116(H) | mm |
| Interface | 3-wire SPI + RGB interface | -- |
| Operating temperature | -20 ~ +70 | °C |
| Storage temperature | -30 ~ +80 | °C |
| Back Light | 8 White LEDS | -- |
| Weight | TBD | g |

Note 1: Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: RoHS

Note 3: LCM weight tolerance: +/- 5%

CTP

| ITEM | STANDARD VALUES | UNITS |
|--------------------|---------------------------|-------|
| CTP type | Cover Lens + sensor + FPC | -- |
| CTP Driver IC | FT5426 | -- |
| Surface Treatment | 6H | -- |
| Transmittance | ≥85% | -- |
| The cover hardness | 6H | -- |
| CTP size | 66.10(W)×88.90(H)×1.53(T) | mm |
| CTP Active area | 53.37(W)×71.42(H) | mm |
| CTP Interface | I2C | |
| response time | 10 | ms |

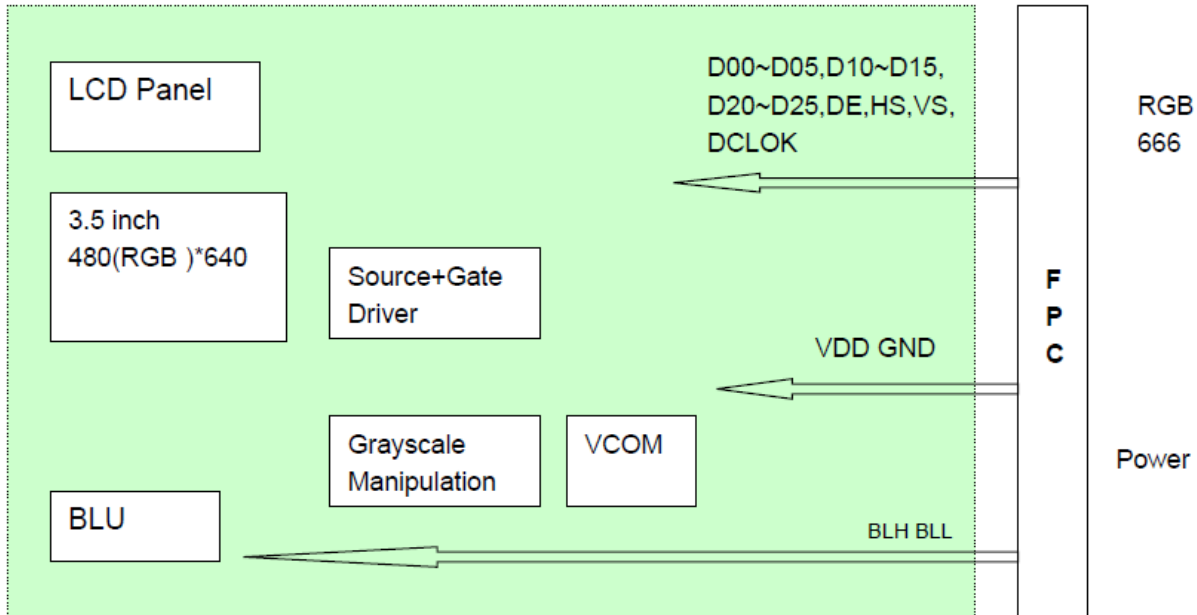
4. Interface Description

| PIN | PIN NAME | DESCRIPTION |
|-------|----------|---|
| 1 | ENABLE | Data enable signal in RGB I/F mode |
| 2-4 | GND | Power ground |
| 5 | NC | NC |
| 6-11 | R0-R5 | RED DATE |
| 12-17 | G0-G5 | GREEN DATE |
| 18-23 | B0-B5 | BIUE DATE |
| 24 | SCL | Serial clock input in SPI interface |
| 25 | SDI | Serial input signal in SPI I/F. |
| 26 | CS | Chip Select pin for Serial Mode Interface |
| 27 | DOTCLK | Pixel clock signal in RGB I/F. |
| 28 | RESET | Reset pin |
| 29 | HS | Horizontal sync signal in RGB I/F. |
| 30 | VS | Vertical sync signal in RGB I/F. |
| 31-32 | VCI | A supply voltage to the analog circuit. |
| 33 | GND | Power ground |
| 34 | LEDK | LED backlight (Cathode). |
| 35 | LEDA | LED backlight (Anode). |
| 36 | NC | NC |
| 36 | NC | NC |
| 36 | NC | NC |
| 36 | NC | NC |
| 40 | GND | Power ground |

CTP

| Pin | Symbol | Description. |
|-----|----------|---|
| 1 | VDD 3.3V | Power supply. |
| 2 | INT | CTP interruption signal. |
| 3 | RST | CTP reset pin. Active low to enter reset state. |
| 4 | SCL | CTP I2C_clock. |
| 5 | SDA | CTP I2C_data. |
| 6 | GND | Power ground |

Block Diagram



5. Absolute Maximum Ratings

Driving TFT LCD Panel

| Item | Symbol | MIN | MAX | Unit | Remark |
|-----------------------|-----------|------|-----|------|--------|
| Supply Voltage | V_{DD} | -0.3 | 4.6 | V | |
| Operating Temperature | T_{OPR} | -20 | 70 | °C | |
| Storage Temperature | T_{STG} | -30 | 80 | °C | |

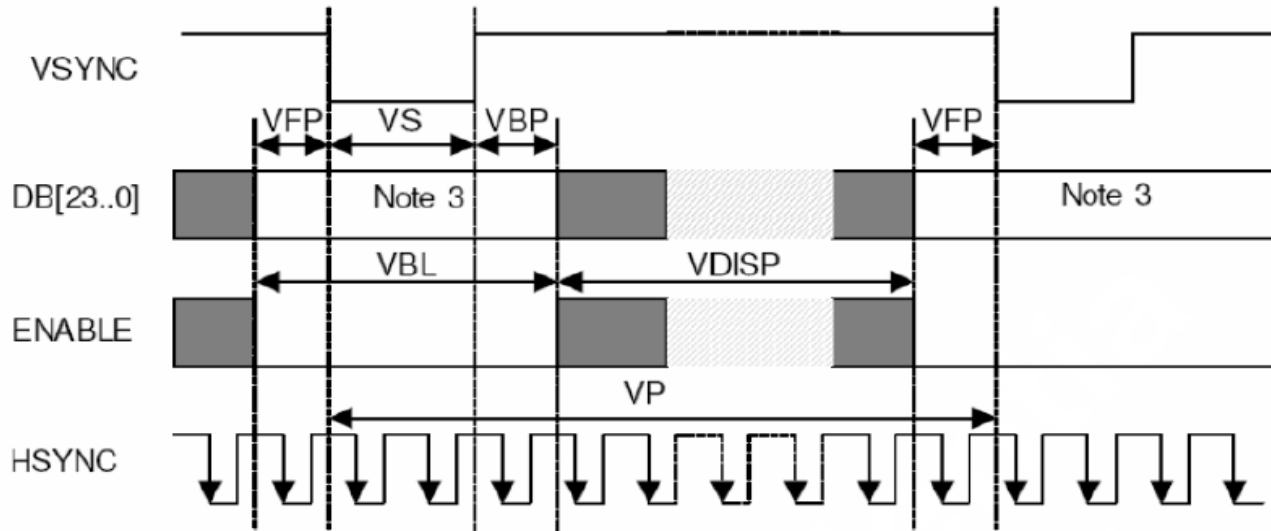
6. DC Characteristics

| Item | | Symbol | MIN | TYP | MAX | Unit | Remark |
|-----------------------|------------|----------|--------------|-----|--------------|------|--------|
| Supply Voltage | | V_{CC} | 2.5 | 3.0 | 3.3 | V | |
| | | $IOVCC$ | 1.65 | 3.0 | 3.3 | | |
| Input Signal Voltage | Low Level | V_{IL} | 0 | - | 0.3x $IOVCC$ | V | |
| | High Level | V_{IH} | 0.7x $IOVCC$ | - | $IOVCC$ | V | |
| Output Signal Voltage | Low Level | V_{OL} | 0 | - | 0.2* $IOVCC$ | V | |
| | High Level | V_{OH} | 0.8* $IOVCC$ | - | $IOVCC$ | V | |

7. Timing Characteristics

7.1 RGB Interface Timing

Vertical Timings for RGB I/F



(Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70 °C)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|--------|------------|------|------|------|------|
| Vertical cycle | VP | - | 860 | - | 864 | Line |
| Vertical low pulse width | VS | - | 2 | - | 4 | Line |
| Vertical front porch | VFP | - | 2 | - | 4 | Line |
| Vertical back porch | VBP | - | 2 | - | 4 | Line |
| Vertical data start point | - | VS+VBP | 4 | - | 8 | Line |
| Vertical blanking period | VBL | VS+VBP+VFP | 6 | - | 10 | Line |
| Vertical active area | - | VDISP | - | 854 | - | Line |
| Vertical Refresh rate | VRR | - | 50 | - | 70 | Hz |

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.

(3) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(4) VRR must keep from 50Hz to 70Hz when adjust other items.

(Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70 °C)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---------------------------|--------|------------|------|------|------|------|
| Vertical cycle | VP | - | 806 | - | 810 | Line |
| Vertical low pulse width | VS | - | 2 | - | 4 | Line |
| Vertical front porch | VFP | - | 2 | - | 4 | Line |
| Vertical back porch | VBP | - | 2 | - | 4 | Line |
| Vertical data start point | - | VS+VBP | 4 | - | 8 | Line |
| Vertical blanking period | VBL | VS+VBP+VFP | 6 | - | 10 | Line |
| Vertical active area | - | VDISP | - | 800 | - | Line |
| Vertical Refresh rate | VRR | - | 50 | - | 70 | Hz |

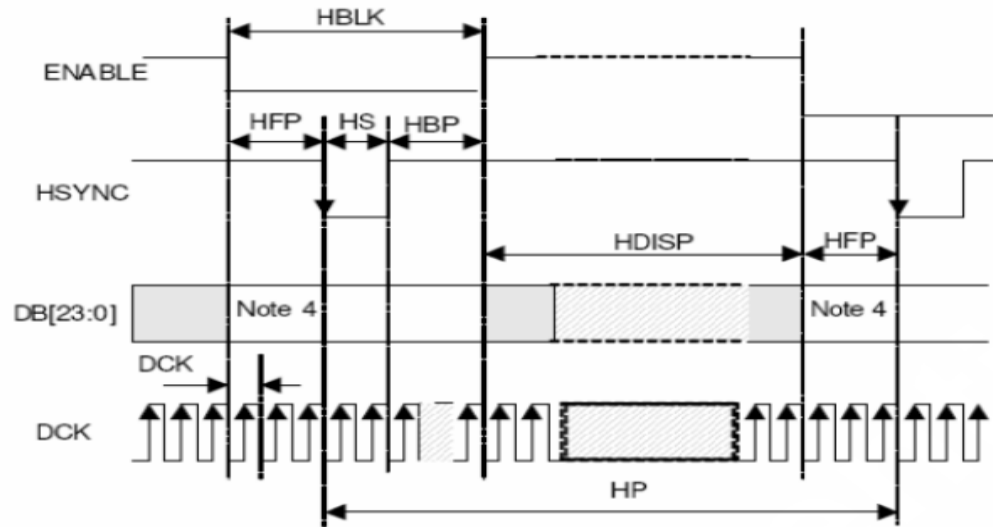
Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.

(3) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(4) VRR must keep from 50Hz to 70Hz when adjust other items.

Horizontal Timings for RGB I/F



(Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70°C)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|--------|--------------------------------|--------------|------|--------------|-----------|
| HS cycle | HP | Note ⁽³⁾ | 504 | - | 568 | DCK |
| HS low pulse width | HS | - | 5 | - | 78 | DCK |
| Horizontal back porch | HBP | - | 5 | - | 78 | DCK |
| Horizontal front porch | HFP | - | 5 | - | 78 | DCK |
| Horizontal data start point | - | HS+HBP | 19 | - | 83 | DCK |
| Horizontal blanking period | HBLK | HS+HBP+HFP | 24 | - | 88 | DCK |
| Horizontal active area | HDISP | - | - | 480 | - | DCK |
| Pixel clock frequency When RGB I/F is running | DCK | VRR = Min. 50Hz - Max. 70Hz | 21.6 29.1 | - | 34.3 46.2 | MHz ns |

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.

(3) HP is multiples of eight DCK.

(4) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(5) VRR must keep from 50Hz to 70Hz when adjust other items.

(Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70°C)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|--------|--------------------------------|------------|------|--------------|-----------|
| HS cycle | HP | Note ⁽³⁾ | 504 | - | 568 | DCK |
| HS low pulse width | HS | - | 5 | - | 78 | DCK |
| Horizontal back porch | HBP | - | 5 | - | 78 | DCK |
| Horizontal front porch | HFP | - | 5 | - | 78 | DCK |
| Horizontal data start point | - | HS+HBP | 19 | - | 83 | DCK |
| Horizontal blanking period | HBLK | HS+HBP+HFP | 24 | - | 88 | DCK |
| Horizontal active area | HDISP | - | - | 480 | - | DCK |
| Pixel clock frequency When RGB I/F is running | DCK | VRR = Min. 50Hz - Max. 70Hz | 20.3 31 | - | 32.2 49.2 | MHz ns |

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.

(3) HP is multiples of eight DCK.

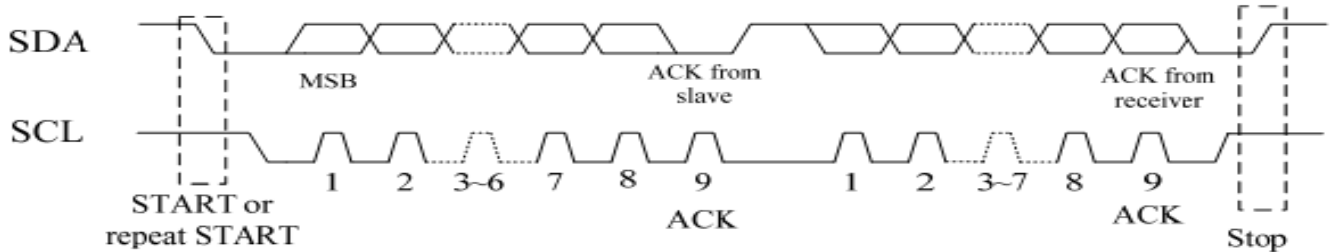
(4) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(5) VRR must keep from 50Hz to 70Hz when adjust other items.

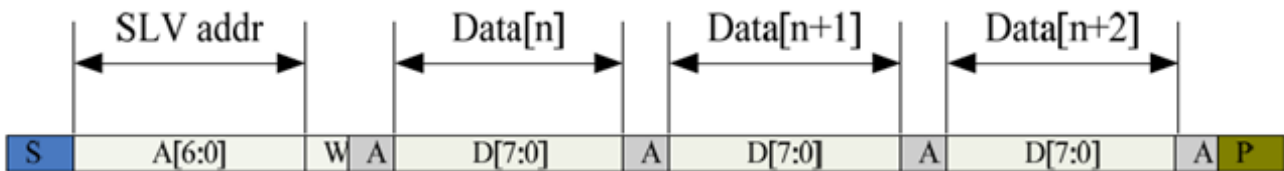
7.2 CTP Timing characteristics

7.2.1 Serial Interface

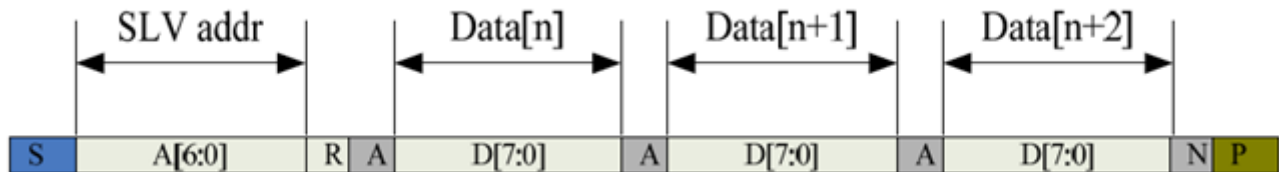
I²C



I²C Serial Data Transfer Format



I²C master write, slave read



I²C master read, slave write

Mnemonics Description

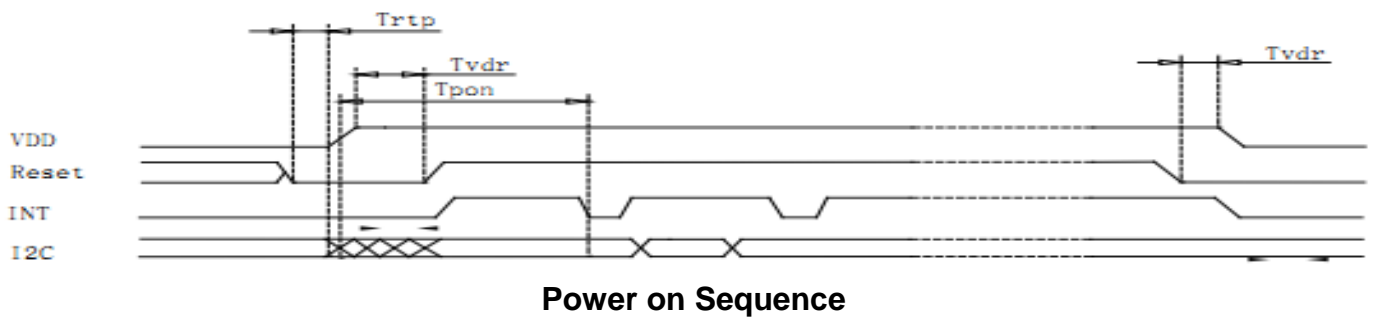
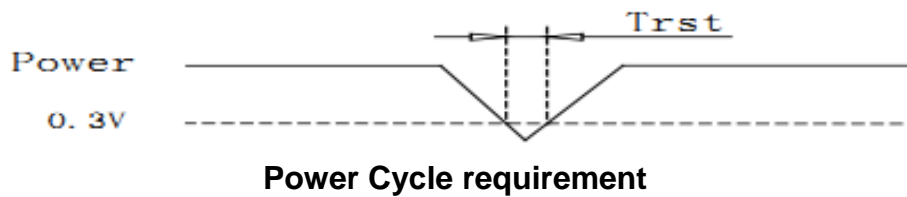
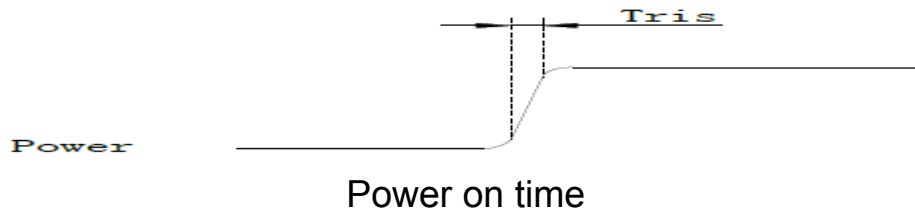
| Mnemonics | Description |
|-----------|--|
| S | I2C Start or I2C Restart |
| A[6:0] | Slave address A[6:0]: address bits are identical to those of I2CADDR [7:1] register. |
| R/ W | '1' for read, '0' for write |
| A(N) | ACK(NACK) |
| P | STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet) |

Timing Characteristics

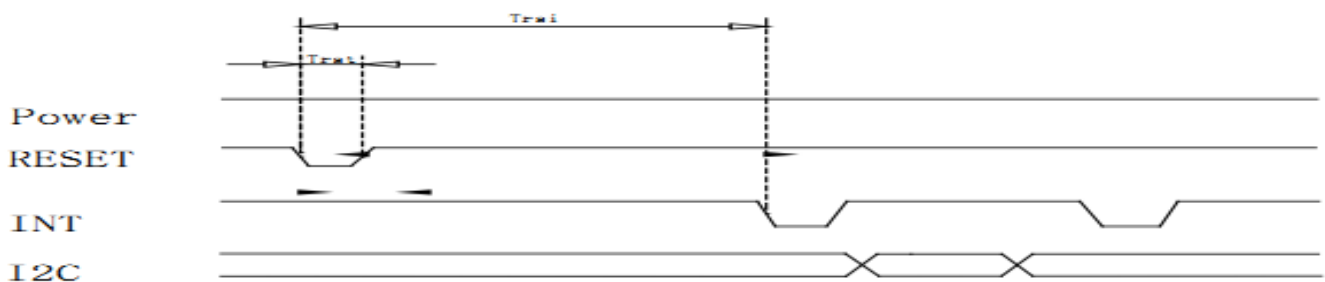
| Mnemonics | Description |
|-----------|--|
| S | I2C Start or I2C Restart |
| A[6:0] | Slave address |
| R/ W | READ/WRITE bit, '1' for read, '0' for write |
| A(N) | ACK(NACK) bit |
| P | STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet) |

7.2.2 POWER NO /Reset/Wake Sequence

Reset should be pulled down to be low before powering on and powering down. I2C shouldn't be used by other devices during Reset time after VDD powering on (T_{rtp}). INT signal will be sent to the host after initializing all parameters and then start to report points to the host. If Power is down, the voltage of supply must be below 0.3V and T_{rst} is more than 1ms.



Reset time must be enough to guarantee reliable reset, the time of starting to report point after resetting approach to the time of starting to report point after powering on.



Power on/Reset Sequence Parameters

| Parameter | Description | Min | Max | Units |
|-----------|--|-----|-----|---------|
| Tris | Rise time from 0.1VDD to 0.9VDD | -- | 5 | ms |
| Trtp | Time of resetting to be low before powering on | 100 | -- | μ s |
| Tpon | Time of starting to report point after powering on | 200 | -- | ms |
| Tvdr | Reset time after VDD powering on | 1 | -- | ms |
| Trsi | Time of starting to report point after resetting | 200 | -- | ms |
| Trst | Reset time | 1 | -- | ms |

8. Backlight Characteristic

| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|-----------------------------|----------|-----|------|-----|------|--------|
| Forward Current | I_F | - | 20 | | mA | |
| Forward Voltage | V_F | 24 | 25.6 | | V | |
| Backlight Power consumption | W_{BL} | - | TBD | - | W | |

Note 1: Each LED : $I_F = 20 \text{ mA}$, $V_F = 3.2 \text{ V}$.

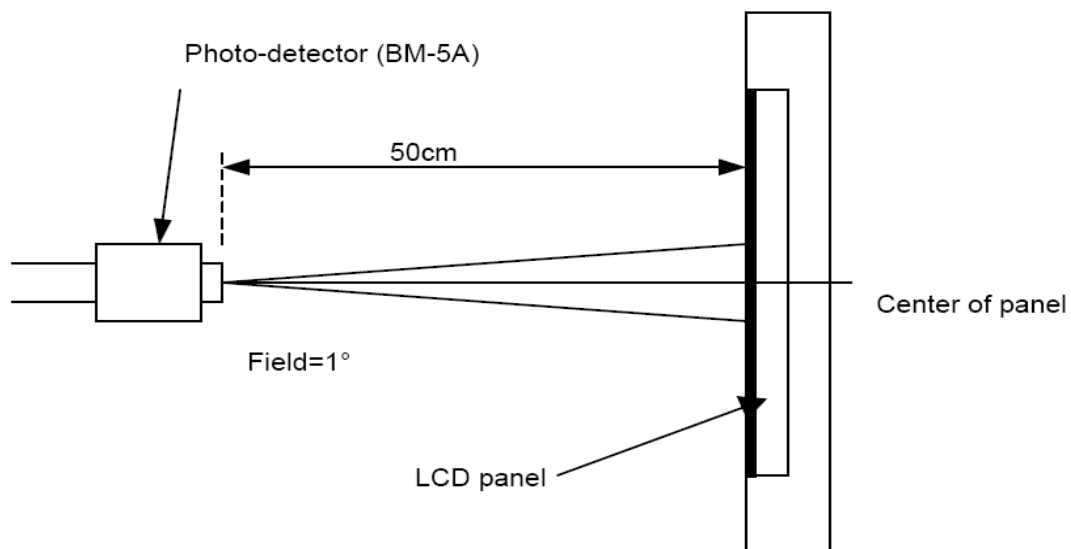
Note 2: Optical performance should be evaluated at $T_a = 25^\circ\text{C}$ only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

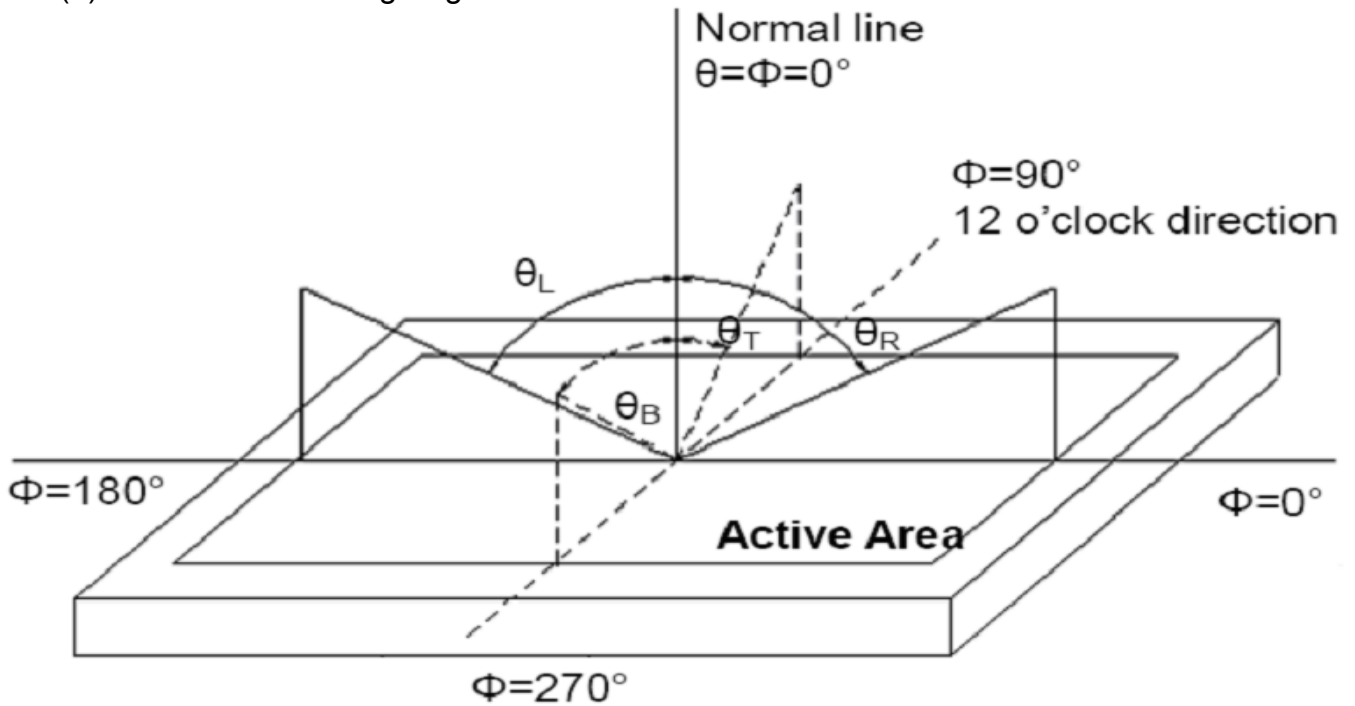
9. Optical Characteristics

| Item | Conditions | Min. | Typ. | Max. | Unit | Note |
|---------------------------------------|----------------|---------------|------|---------------|-------------------|---------------------------|
| Viewing Angle (CR>10) | Horizontal | θ_L | - | 80 | - | degree (1),(2),(6) |
| | | θ_R | - | 80 | - | |
| | Vertical | θ_T | - | 80 | - | |
| | | θ_B | - | 80 | - | |
| Center Luminance of White | Lc | 80 | 100 | - | cd/m ² | |
| Contrast Ratio | Center | - | 300 | - | - | (1),(3),(6) |
| Response Time | Rising | - | 25 | 35 | ms | (1),(4),(6) |
| | Falling | | | | | |
| CF Color Chromaticity (CIE1931) | Red x | Typ. -0.05 | TBD | Typ. +0.05 | - | (1), (6) |
| | Red y | | TBD | | - | |
| | Green x | | TBD | | - | |
| | Green y | | TBD | | - | |
| | Blue x | | TBD | | - | |
| | Blue y | | TBD | | - | |
| | White x | | TBD | | - | |
| | White y | | TBD | | - | |

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



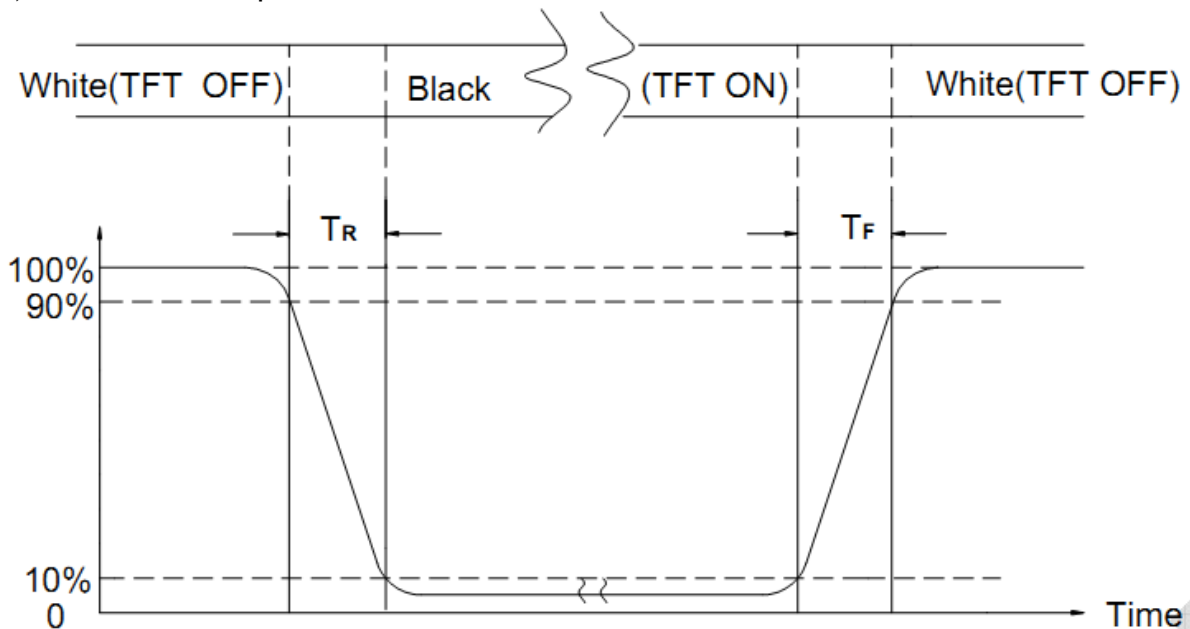
Note (3) Definition of Contrast Ratio (CR)

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 | | | | | | | | | | | |
|---------------------|---|--|---|---------------------|------------------|----------|-----|-------------|----|------------|----|----------|----|
| ① | High Temperature Storage | Keep in 80°C ±5°C 240 hrs Surrounding temperature, then storage at normal condition 4hrs. | | | | | | | | | | | |
| ② | Low Temperature Storage | Keep in -30°C ±5°C 240 hrs Surrounding temperature, then storage at normal condition 4hrs. | | | | | | | | | | | |
| ③ | High Temperature / High Humidity Storage Test | Keep in 60 °C / 90% R.H duration for 240 hrs Surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer) | | | | | | | | | | | |
| ④ | Temperature Cycling Storage Test | $ \begin{array}{ccccccc} -30^{\circ}\text{C} & \rightarrow & +25^{\circ}\text{C} & \rightarrow & 80^{\circ}\text{C} & \rightarrow & +25^{\circ}\text{C} \\ (30\text{mins}) & & (5\text{mins}) & & (30\text{mins}) & & (5\text{mins}) \\ \longleftarrow & & & & & & \longrightarrow \\ & & & & 30 \text{ Cycle} & & \end{array} $ | | | | | | | | | | | |
| ⑤ | ESD Test | Air Discharge: Apply 2 KV with 5 times Discharge for each polarity +/- | Contact Discharge: Apply 250 V with 5 times discharge for each polarity +/- | | | | | | | | | | |
| | | 1. Temperature ambience : 15°C ~ 35°C 2. Humidity relative : 30% ~ 60% 3. Energy Storage Capacitance(Cs + Cd) : 150pF±10% 4. Discharge Resistance(Rd) : 330Ω±10% 5. Discharge, mode of operation : Single Discharge (time between successive discharges at least 1 sec) (Tolerance if the output voltage indication : ±5%) | | | | | | | | | | | |
| ⑥ | Vibration Test (Packaged) | 1. Sine wave 10~55 Hz frequency (1 min/sweep) 2. The amplitude of vibration :1.5 mm 3. Each direction (X、 Y、 Z) duration for 2 Hrs | | | | | | | | | | | |
| ⑦ | Drop Test (Packaged) | <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">Packing Weight (Kg)</th> <th style="padding: 5px;">Drop Height (cm)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">0 ~ 45.4</td> <td style="text-align: center; padding: 5px;">122</td> </tr> <tr> <td style="text-align: center; padding: 5px;">45.4 ~ 90.8</td> <td style="text-align: center; padding: 5px;">76</td> </tr> <tr> <td style="text-align: center; padding: 5px;">90.8 ~ 454</td> <td style="text-align: center; padding: 5px;">61</td> </tr> <tr> <td style="text-align: center; padding: 5px;">Over 454</td> <td style="text-align: center; padding: 5px;">46</td> </tr> </tbody> </table> <p style="margin-left: 20px;">Drop Direction :※1 corner / 3 edges / 6 sides each 1time</p> | | Packing Weight (Kg) | Drop Height (cm) | 0 ~ 45.4 | 122 | 45.4 ~ 90.8 | 76 | 90.8 ~ 454 | 61 | Over 454 | 46 |
| Packing Weight (Kg) | Drop Height (cm) | | | | | | | | | | | | |
| 0 ~ 45.4 | 122 | | | | | | | | | | | | |
| 45.4 ~ 90.8 | 76 | | | | | | | | | | | | |
| 90.8 ~ 454 | 61 | | | | | | | | | | | | |
| Over 454 | 46 | | | | | | | | | | | | |

11. Inspection Standard

11.1. QUALITY :

THE QUALITY OF GOODS SUPPLIED TO PURCHASER SHALL COME UP TO THE FOLLOWING STANDARD.

11.1.1. INSPECTION TOOLS AND INSTRUMENTS

Vernier calipers, film scales, multimeter, magnifying eyepiece, ND5%, luminance meter and so on.

11.1.2. THE METHOD OF PRESERVING GOODS

AFTER DELIVERY OF GOODS FROM AMSON TO PURCHASER. PURCHASER SHALL CONTROL THE LCM AT -10 TO 40 ,AND IT MIGHT BE DESIRABLE TO KEEP AT THE NORMAL ROOM TEMPERATURE AND HUMIDITY UNTIL INCOMING INSPECTION OR THROWING INTO PROCESS LINE.

11.1.3. INCOMING INSPECTION

(A) THE METHOD OF INSPECTION

IF PURCHASER MAKE AN INCOMING INSPECTION , A SAMPLING PLAN SHALL BE APPLIED ON THE CONDITION THAT QUALITY OF ONE DELIVERY SHALL BE REGARDED AS ONE LOT.

(B) THE STANDARD OF QUALITY

ISO-2859-1 (SAME AS MIL-STD-105E) ,LEVEL:II

| CLASS | AQL(%) |
|----------|--------|
| CRITICAL | 0.4 % |
| MAJOR | 0.65 % |
| MINOR | 1.5 % |

EVERY ITEM SHALL BE INSPECTED ACCORDING TO THE CLASS.

(C) MEASURE

IF AS THE RESULT OF ABOVE RECEIVING INSPECTION , A LOT OUT IS DISCOVERED. PURCHASER SHALL BE INFORM SELLER OF IT WITHIN SEVEN DAYS. BUT FIRST SHIPMENT WITHIN FOURTEEN DAYS.

11.1.4. WARRANTY POLICY

AMSON WILL PROVIDE ONE-YEAR WARRANTY FOR THE PRODUCTS ONLY IF UNDER SPECIFICATION OPERATING CONDITIONS. AMSON WILL REPLACE NEW PRODUCTS FOR THESE DEFECT PRODUCTS WHICH UNDER WARRANTY PERIOD AND BELONG TO THE RESPONSIBILITY OF AMSON.

11.2. CHECKING CONDITION

11.2.1.CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

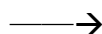
11.2.2.CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE

11.2.3.Ambient Illumination:

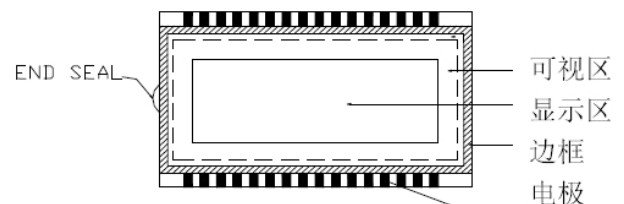
0 ~30 Lux for functional inspection

500 ~ 1200 Lux for external appearance inspection.

11.2.4. TEST AREA:



11.2.5. Inspection should be carried out with rope electrostatic ring and static finger cover (both hands except small fingers must be worn)



11.2.6. The inspector may make a visual inspection or a comparative examination with a film ruler and a magnifying eyepiece. Individual defects shall be determined according to the limited samples.

11.2.7. Functional testing uses electrical testing fixtures or test fixtures required by customers.

11.2.8. the ion fan should be used when testing.

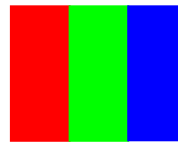
11.2.9. the principle of judgment

11.3.1 If the defect outside the visual area does not affect the assembly and display, it will be judged as a good product.

11.3.2 Poor definition

Pixel:

A combination of three sub-pixels
(Red + Green + Blue).



Dot:

Any of the sub-pixels
(Red or Green or Blue).



Bright and dark dots:

A point pixel (sub-pixel: R, G, B pixels) is lit or turned off during the display function test.

Highlights:

Usually considered to be shown on a black screen.

Dark spots:

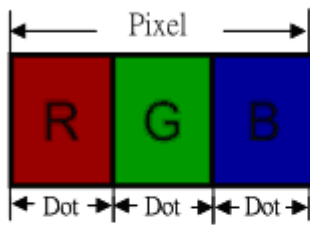
They are generally considered to be shown on R, G, B solid colors or white images.

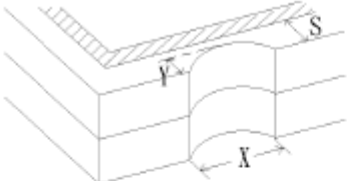
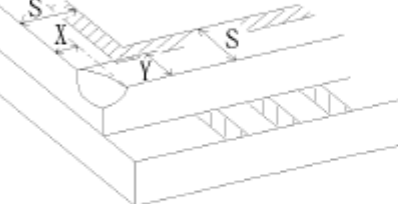
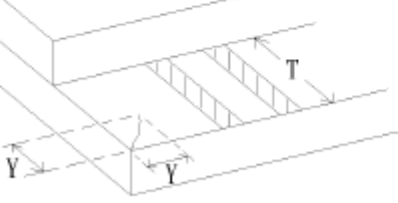
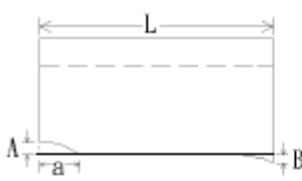
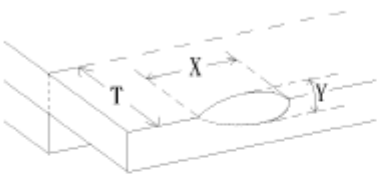
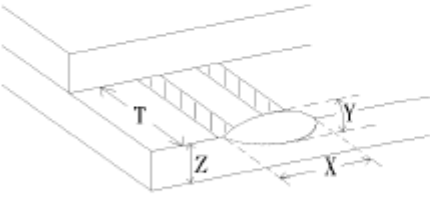
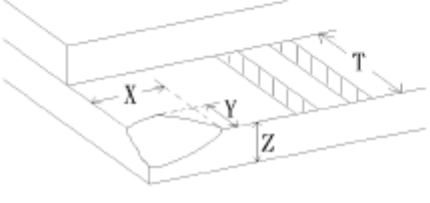
Neighborhood:

Two or three adjacent point pixels (dot: sub-pixel) connected together (R, G or G, B or B, R or RGB).

11.3. INSPECTION PLAN :

| CLASS | ITEM | JUDGEMENT | CLASS |
|--------------------|--|--|----------|
| PACKING & INDICATE | 1. OUTSIDE AND INSIDE PACKAGE | "MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE. | Minor |
| | 2. MODEL MIXED AND QUANTITY | OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED | Critical |
| | 3. PRODUCT INDICATION | "MODEL NO." SHOULD INDICATE ON THE PRODUCT | Major |
| ASSEMBLY | 4. DIMENSION, LCD GLASS SCRATCH AND SCRIBE DEFECT. | ACCORDING TO SPECIFICATION OR DRAWING. | Major |
| APPEARANCE | 5. VIEWING AREA | POLARIZER EDGE OR LCD'S SEALING LINE IS VISABLE IN THE VIEWING AREAREJECTED | Minor |
| | 6. BLEMISH · BLACK SPOT · WHITE SPOT IN THE LCD AND LCD GLASS CRACKS | ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA) | Minor |
| | 7. BLEMISH · BLACK SPOT WHITE SPOT AND SCRATCH ON THE POLARIZER | ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA) | Minor |
| | 8. BUBBLE IN POLARIZER | ACCORDING TO STANDARD OF VISUAL INSPECTION(INSIDE VIEWING AREA) | Minor |
| | 9. LCD'S RAINBOW COLOR | STRONG DEVIATION COLOR (OR NEWTON RING) OF LCD.....REJECTED. OR ACCORDING TO LIMITED SAMPLE (IF NEEDED, AND INSIDE VIEWING AREA) | Minor |
| ELECTRICAL | 10. ELECTRICAL AND OPTICAL CHARACTERISTICS (CONTRAST· VOP· CHROMATICITY ... ETC) | ACCORDING TO SPECIFICATION OR DRAWING . (INSIDE VIEWING AREA) | Critical |
| | 11.MISSING LINE | MISSING DOT· LINE · CHARACTERREJECTED | Critical |
| | 12.SHORT CIRCUIT· WRONG PATTERN DISPLAY | NO DISPLAY · WRONG PATTERN DISPLAY · CURRENT CONSUMPTION OUT OF SPECIFICATION..... REJECTED | Critical |
| | 13. DOT DEFECT (FOR COLOR AND TFT) | ACCORDING TO STANDARD OF VISUAL INSPECTION | Minor |

| NO. | CLASS | ITEM | JUDGEMENT | | | | | | | | | | | | | | | | | | | | |
|------------------------|-----------------------------------|--|---|----------------|-----------------|------------------|-----------------------------------|------------------------|-----------------------------------|--------------|---|--------|-------|-----------------|-------|---------------|--------------|--------------|----------------------|-------------------|-------|------------|-------------------|
| 11.4.1 | MINOR | BLACK AND WHITE SPOT FOREIGN MATERIEL DUST IN THE CELL BLEMISH SCRATCH | <p>(A) ROUND TYPE: unit : mm.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;">DIAMETER (mm.)</th> <th style="width: 40%;">ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.15$</td> <td style="text-align: center;">Distance>1mm</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.4$</td> <td style="text-align: center;">3 (Distance>15mm)</td> </tr> <tr> <td style="text-align: center;">$0.4 < \Phi$</td> <td style="text-align: center;">0</td> </tr> </tbody> </table> <p style="text-align: center;">NOTE: $\Phi = (\text{LENGTH} + \text{WIDTH}) / 2$</p> <p>(B) LINEAR TYPE: unit : mm.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">LENGTH</th> <th style="width: 30%;">WIDTH</th> <th style="width: 50%;">ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">-----</td> <td style="text-align: center;">$W \leq 0.03$</td> <td style="text-align: center;">Distance>1mm</td> </tr> <tr> <td style="text-align: center;">$L \leq 4.0$</td> <td style="text-align: center;">$0.03 < W \leq 0.05$</td> <td style="text-align: center;">3 (Distance>15mm)</td> </tr> <tr> <td style="text-align: center;">-----</td> <td style="text-align: center;">$0.05 < W$</td> <td style="text-align: center;">FOLLOW ROUND TYPE</td> </tr> </tbody> </table> | DIAMETER (mm.) | ACCEPTABLE Q'TY | $\Phi \leq 0.15$ | Distance>1mm | $0.15 < \Phi \leq 0.4$ | 3 (Distance>15mm) | $0.4 < \Phi$ | 0 | LENGTH | WIDTH | ACCEPTABLE Q'TY | ----- | $W \leq 0.03$ | Distance>1mm | $L \leq 4.0$ | $0.03 < W \leq 0.05$ | 3 (Distance>15mm) | ----- | $0.05 < W$ | FOLLOW ROUND TYPE |
| DIAMETER (mm.) | ACCEPTABLE Q'TY | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.15$ | Distance>1mm | | | | | | | | | | | | | | | | | | | | | | |
| $0.15 < \Phi \leq 0.4$ | 3 (Distance>15mm) | | | | | | | | | | | | | | | | | | | | | | |
| $0.4 < \Phi$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| LENGTH | WIDTH | ACCEPTABLE Q'TY | | | | | | | | | | | | | | | | | | | | | |
| ----- | $W \leq 0.03$ | Distance>1mm | | | | | | | | | | | | | | | | | | | | | |
| $L \leq 4.0$ | $0.03 < W \leq 0.05$ | 3 (Distance>15mm) | | | | | | | | | | | | | | | | | | | | | |
| ----- | $0.05 < W$ | FOLLOW ROUND TYPE | | | | | | | | | | | | | | | | | | | | | |
| 11.4.2 | MINOR | BUBBLE IN POLARIZER DENT ON POLARIZER | <p style="text-align: right;">unit : mm.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;">DIAMETER</th> <th style="width: 40%;">ACCEPTABLE Q'TY</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.2$</td> <td style="text-align: center;">Distance>1mm</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi \leq 0.3$</td> <td style="text-align: center;">3 (Distance>15mm)</td> </tr> <tr> <td style="text-align: center;">$0.3 < \Phi$</td> <td style="text-align: center;">0</td> </tr> </tbody> </table> | DIAMETER | ACCEPTABLE Q'TY | $\Phi \leq 0.2$ | Distance>1mm | $0.2 < \Phi \leq 0.3$ | 3 (Distance>15mm) | $0.3 < \Phi$ | 0 | | | | | | | | | | | | |
| DIAMETER | ACCEPTABLE Q'TY | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.2$ | Distance>1mm | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < \Phi \leq 0.3$ | 3 (Distance>15mm) | | | | | | | | | | | | | | | | | | | | | | |
| $0.3 < \Phi$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 11.4.3 | MINOR | Dot Defect | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Items</th> <th style="width: 50%;">ACC. Q'TY</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td style="text-align: center;">$N \leq 2$ (Distance\geq15mm)</td> </tr> <tr> <td>Dark dot</td> <td style="text-align: center;">$N \leq 3$ (Distance\geq15mm)</td> </tr> </tbody> </table> <p>Pixel Define :</p>  <p>Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot. Definition: $< 1/2 \text{dot}$ and visible by 5% ND filter $N \leq 5$</p> <p>Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.</p> | Items | ACC. Q'TY | Bright dot | $N \leq 2$ (Distance \geq 15mm) | Dark dot | $N \leq 3$ (Distance \geq 15mm) | | | | | | | | | | | | | | |
| Items | ACC. Q'TY | | | | | | | | | | | | | | | | | | | | | | |
| Bright dot | $N \leq 2$ (Distance \geq 15mm) | | | | | | | | | | | | | | | | | | | | | | |
| Dark dot | $N \leq 3$ (Distance \geq 15mm) | | | | | | | | | | | | | | | | | | | | | | |
| 11.4.4 | MINOR | Mura | Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary | | | | | | | | | | | | | | | | | | | | |

| NO. | CLASS | ITEM | JUDGEMENT |
|---------|-------|--|--|
| 11.4.4 | MINOR | LCD GLASS CHIPPING |  $Y > S$ Reject |
| 11.4.5 | MINOR | LCD GLASS CHIPPING |  $X \text{ or } Y > S$ Reject |
| 11.4.6 | MAJOR | LCD GLASS GLASS CRACK |  $Y > (1/2) T$ Reject |
| 11.4.7 | MAJOR | LCD GLASS SCRIBE DEFECT |  <ol style="list-style-type: none"> $a > L/3$, $A > 1.5\text{mm}$. Reject B : ACCORDING TO DIMENSION |
| 11.4.8 | MINOR | LCD GLASS CHIPPING (ON THE TERMINAL AREA) |  $\Phi = (x+y)/2 > 2.5 \text{ mm}$ Reject |
| 11.4.9 | MINOR | LCD GLASS CHIPPING (ON THE TERMINAL SURFACE) |  $Y > (1/3) T$ Reject |
| 11.4.10 | MINOR | LCD GLASS CHIPPING |  $Y > T$ Reject |

12. Handling Precautions

12.1 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.

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 silicon 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 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.

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.
- 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 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

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 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.

14. Packing Method

TBD