# Specification for Approval

Customer:_____

Model Name:_____

| Supplier Approval | | | Customer approval |
|---|---|---|---|
| R&D Designed | R&D Approved | QC Approved | |
| Peter | Peng Jun | | |

# Revision Record

| REV NO. | REV DATE | CONTENTS | Note |
|---|---|---|---|
| A | 2019-04-22 | NEW ISSUE | |
| B | 2019-06-26 | MODIFY CTP | |
| C | 2020-03-12 | Revised BL Luminous to 250nits(Type) | |
| D | 2024-03-08 | Update CTP Outline | P.5 |
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# Table of Contents

## 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

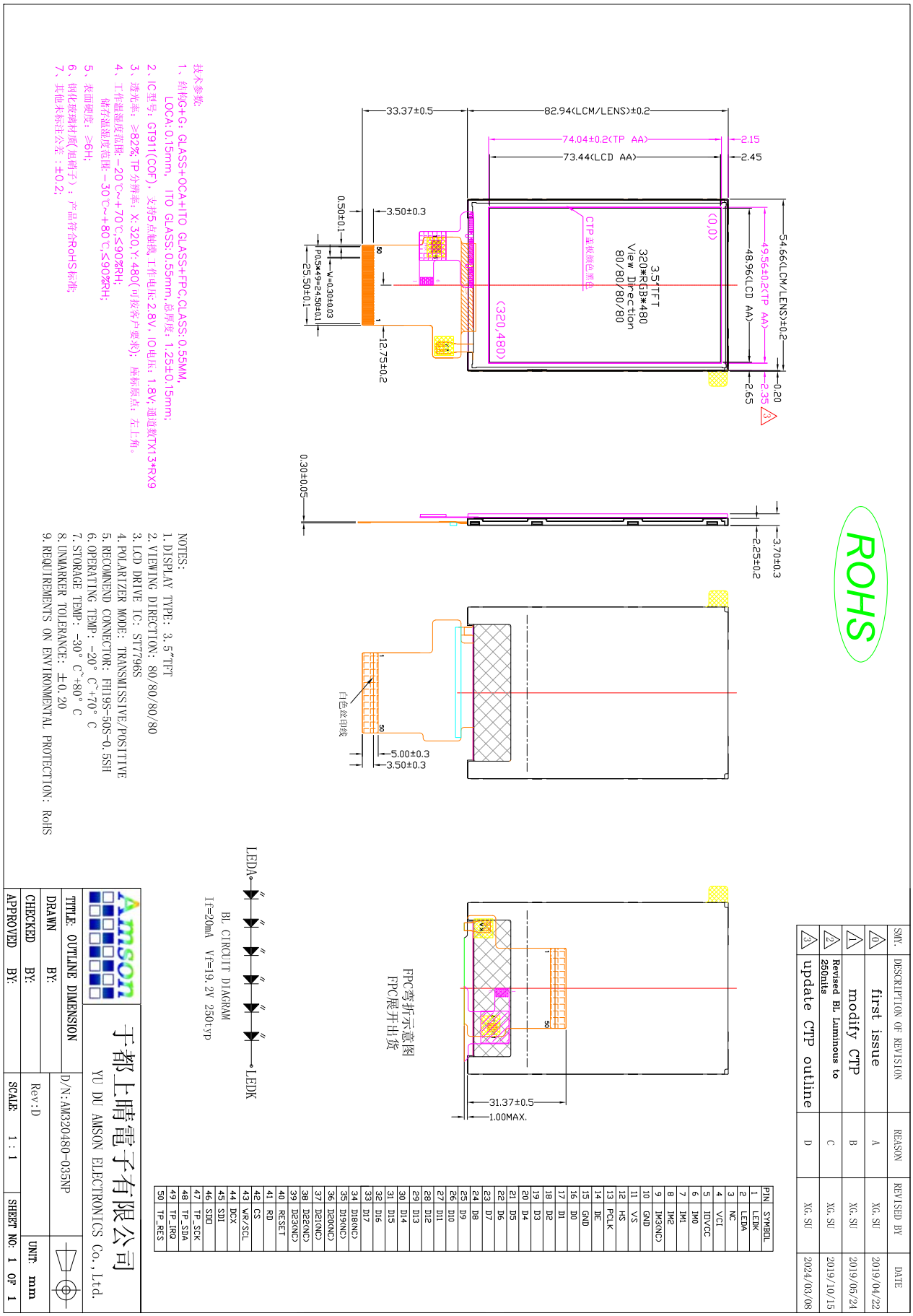
### LCM

| ITEM | STANDARD VALUES | UNITS |
|---|---|---|
| LCD type | 3.5”TFT | -- |
| Dot arrangement | 320(RGB)×480 | dots |
| Color filter array | RGB vertical stripe | -- |
| Display mode | IPS / Transmission / Normally Black | - |
| Gray Scale Inversion Direction | 80/80/80/80 | -- |
| Eyes Viewing Direction | ALL | -- |
| Driver IC | ST7796S | -- |
| Module size | 54.66(W)×82.94(H)×3.70(T) | mm |
| Active area | 48.96(W)×73.44(H) | mm |
| Dot pitch | 153(W)×153H) | um |
| Interface | MCU 8/9/16/18bit interface<br>3wrie/4wrie SPI+16/18bit RGB interface | -- |
| Operating temperature | -20 ~ +70 | °C |
| Storage temperature | -30 ~ +80 | °C |
| Back Light | 6White LED | -- |

### CTP

| ITEM | STANDARD VALUES | UNITS |
|---|---|---|
| CTP type | Cover Lens + sensor + FPC | -- |
| CTP Driver IC | GT911 | -- |
| Surface Treatment | 6H | -- |
| Transmittance | ≥82％ | -- |
| The cover hardness | 6H | -- |
| CTP size | 54.66(W)×82.94(H)×1.25(T) | mm |
| CTP Active area | 49.56(W)×70.04(H) | mm |
| CTP Interface | I2C | |
| response time | 10 | ms |

## 3. External Dimensions



## 4. Interface Description

| PIN NO. | PIN NAME | DESCRIPTION |
|---|---|---|
| 1 | LEDK | The cathode of LED power |
| 2 | LEDA | The Anode of LED power |
| 3 | NC | NC |
| 4 | VCI | Analog operating voltage. |
| 5 | IOVCC | Logic operating voltage. |
| 6~8 | IM0~IM2 | MPU interface mode select pin,(FYI NOTE1) |
| 9 | IM3 | NC |
| 10 | GND | Power ground |
| 11 | VS | Frame synchronizing signal for RGB interface operation. |
| 12 | HS | Line synchronizing signal for RGB interface operation. |
| 13 | PCLK | Dot clock signal for RGB interface operation. |
| 14 | DE | Data enable signal for RGB interface operation. |
| 15 | GND | Power ground |
| 16-33 | DB0-DB17 | Data bus |
| 34`39 | DB18~DB23 | NC |
| 40 | RESET | Reset pin setting either pin low initializes the LSI<br>Must be reset after power supplied |
| 41 | RD | Read signal input terminal, Active at ‘L’. |
| 42 | CS | Chip select signal input terminal, Active at ‘L’ |
| 43 | WR/SCL | Serial clock input for SPI interfac |
| 44 | DCX | The SPI interface (DCX): The signal for command or parameter select. |
| 45 | SDI | When IM [3]: Low, Serial in/out signal.<br>When IM [3]: High, Serial input signal.<br>The data is applied on the rising edge of the SCL signal. |
| 46 | SDO | Serial output signal.<br>The data is applied on the rising edge of the SCL signal. |
| 47 | TP_SCK | CTP I2C_clock. |
| 48 | TP_SDA | CTP I2C_data. |

| | | |
|---|---|---|
| 49 | TP_IRQ | CTP interruption signal. |
| 50 | TP_RES | CTP reset pin. Active low to enter reset state. |

Note1: The System interface mode select

| IM2 | IM1 | IM0 | MPU Interface Mode | Data pin |
|---|---|---|---|---|
| 0 | 0 | 0 | 8080 18-bit Interface | DB[17:0] |
| 0 | 0 | 1 | 8080 9-bit Interface | DB[8:0] |
| 0 | 1 | 0 | 8080 16-bit Interface | DB[15:0] |
| 0 | 1 | 1 | 8080 8-bit Interface | DB[7:0], |
| 1 | 0 | 0 | Reserve | -- |
| 1 | 0 | 1 | 3SPI | SDA, SDO |
| 1 | 1 | 0 | MIPI | MIPI_DATA<br>MIPI_CLOCK |
| 1 | 1 | 1 | 4Line SPI | SDA, SDO |

## 5. Absolute Maximum Ratings

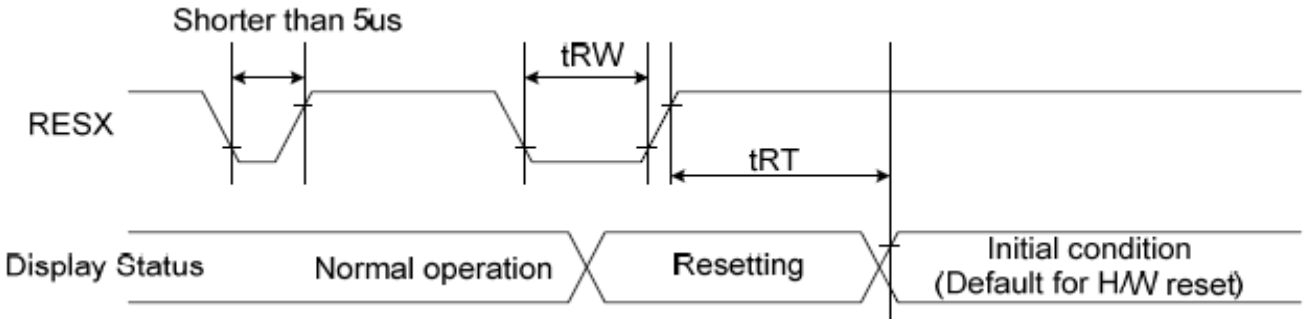
| Item | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Logic Supply Voltage | IOVCC | -0.3 | 3.3 | V |
| Analog Supply Voltage | VCI | -0.3 | 3.3 | V |
| Input Voltage | Vin | -0.3 | IOVCC+0.3 | V |
| Operating Temperature | $T_{OP}$ | -20 | 70 | °C |
| Storage Temperature | $T_{ST}$ | -30 | 80 | °C |
| Storage Humidity | HD | 20 | 90 | %RH |

## 6. DC Characteristics

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Logic Supply Voltage | IOVCC | 1.65 | 1.8 | 3.3 | V | - |
| Analog Supply Voltage | VCI | 2.5 | 2.8 | 3.3 | V | - |
| Input High Voltage | $V_{IH}$ | 0.7*IOVCC | - | IOVCC | V | - |
| Input Low Voltage | $V_{IL}$ | -0.3 | - | 0.3*IOVCC | V | - |
| Output High Voltage | $V_{OH}$ | 0.8*IOVCC | - | IOVCC | V | - |
| Output Low Voltage | $V_{OL}$ | GND | - | 0.2*IOVCC | V | - |
| I/O Leak Current | $I_{LI}$ | -1 | - | 1 | uA | - |

## 7. Timing Characteristics

### 7.1 Reset Timing Characteristics




**Reset Timing**

| Signal | Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|---|
| RESX | tRW | Reset pulse duration | 10 | | uS |
| | tRT | Reset cancel | | 5 (note 1,5) | mS |
| | | | | 120 (note 1,6,7) | mS |

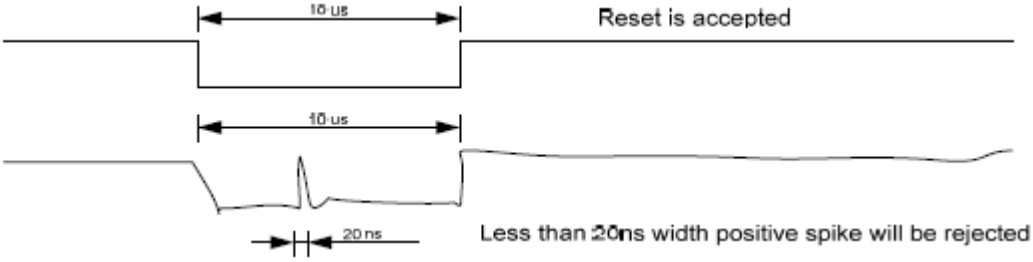
**Notes:**

1. The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (tRT).
2. According to the Table 40, a spike due to an electrostatic discharge on the RESX line does not cause irregular system reset.

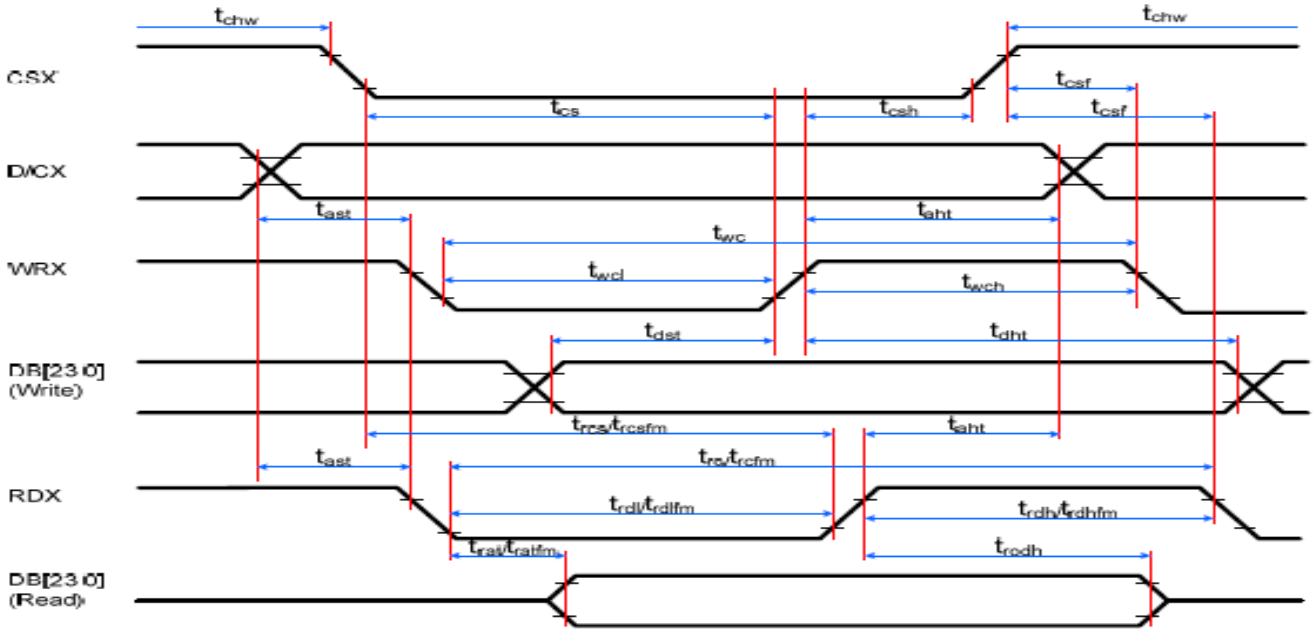
**Reset Description**

| RESX Pulse | Action |
|---|---|
| Shorter than 5us | Reset Rejected |
| Longer than 9us | Reset |
| Between 5us and 9us | Reset starts |

3. During the Reset period, the display will be blanked (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains the blank state in the Sleep In mode.) and then return to the default condition for the Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse, as shown below:

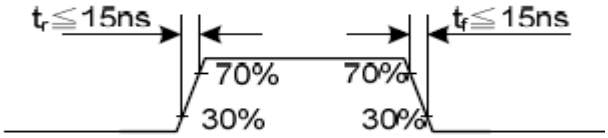


## 7.2 MCU 8/9/16/18-bit Timing Characteristics

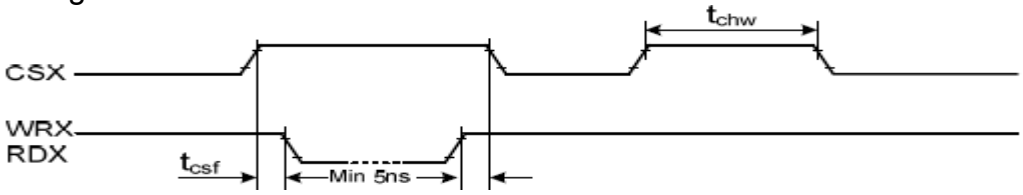



| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| DCX | tast | Address setup time | 0 | - | ns | - |
| | that | Address hold time (Write/Read) | 0 | - | ns | - |
| CSX | tchw | CSX "H" pulse width | 0 | - | ns | - |
| | tcs | Chip Select setup time (Write) | 15 | - | ns | - |
| | trcs | Chip Select setup time (Read ID) | 45 | - | ns | - |
| | trcsfm | Chip Select setup time (Read FM) | 355 | - | ns | - |
| | tcsf | Chip Select Wait time (Write/Read) | 0 | - | ns | - |
| WRX | twc | Write cycle | 30 | - | ns | - |
| | twrh | Write Control pulse H duration | 15 | - | ns | - |
| | twrl | Write Control pulse L duration | 15 | - | ns | - |
| RDX (FM) | trcfm | Read Cycle (FM) | 450 | - | ns | When read from Frame Memory |
| | trdhfm | Read Control H duration (FM) | 90 | - | ns | |
| | trdlfm | Read Control L duration (FM) | 355 | - | ns | |
| RDX (ID) | trc | Read cycle (ID) | 160 | - | ns | When read ID data |
| | trdh | Read Control pulse H duration | 90 | - | ns | |
| | trdl | Read Control pulse L duration | 45 | - | ns | |
| DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [7:0] | tdst | Write data setup time | 10 | - | ns | For maximum, CL=30pF For minimum, CL=8pF |
| | tdht | Write data hold time | 10 | - | ns | |
| | trat | Read access time | - | 40 | ns | |
| | tratfm | Read access time | - | 340 | ns | |
| | trod | Read output disable time | 20 | 80 | ns | |

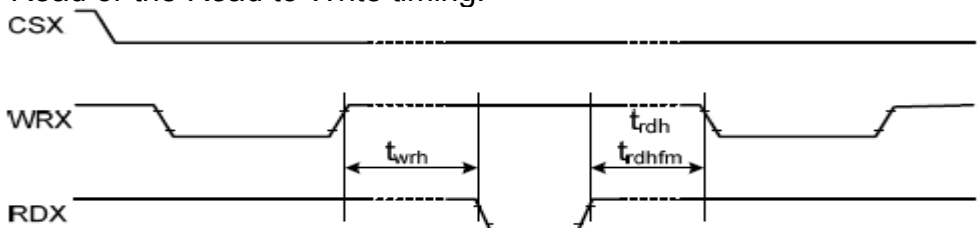
1. Ta = -30 to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V
2. Logic high and low levels are specified as 30% and 70% of IOVCC for input signals.
3. Input signal rising time and falling time:




4. The CSX timing:

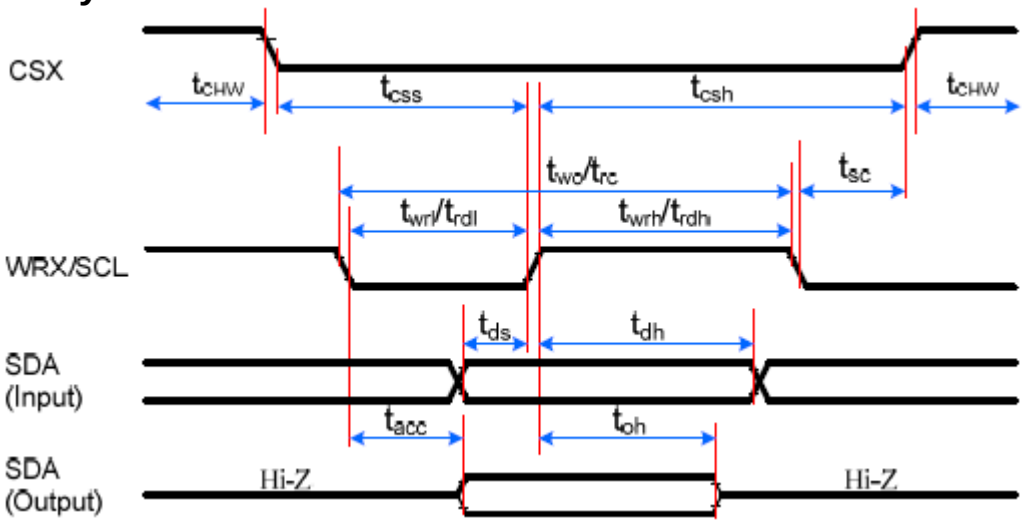


5. The Write to Read or the Read to Write timing:



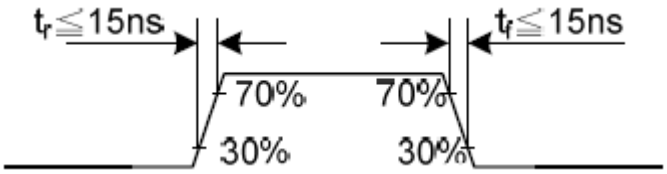

## 7.3 Display Serial Interface Timing Characteristics

### 3-wrie SPI system

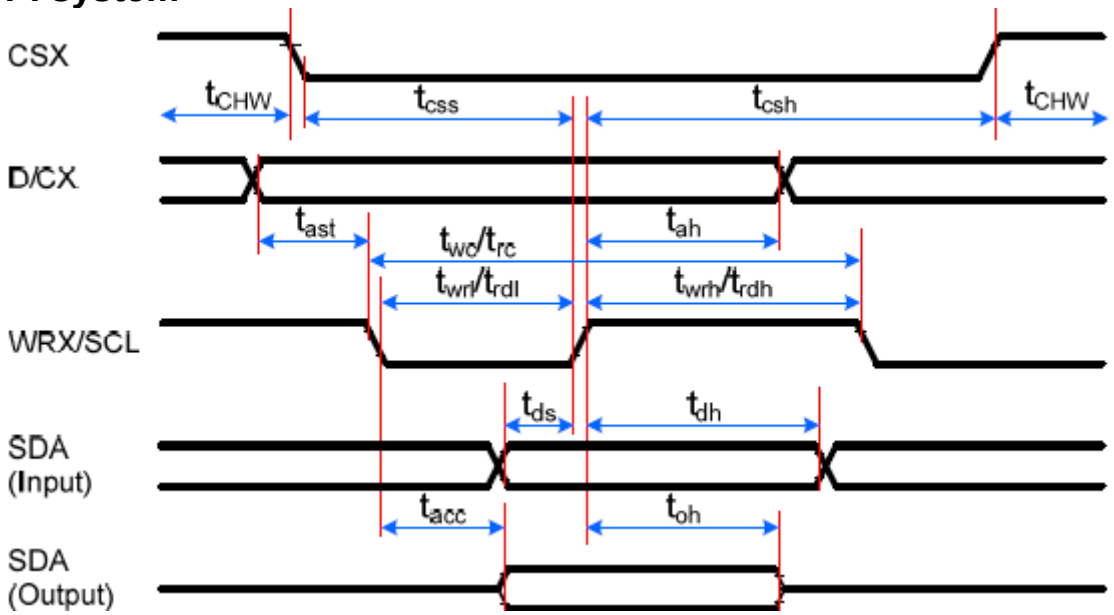



| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | tsc | SCL-CSX | 15 | - | ns | |
| | tchw | CSX H Pulse Width | 40 | - | ns | |
| | tcss | Chip select time (Write) | 60 | - | ns | |
| | tcsh | Chip select hold time (Read) | 65 | - | ns | |
| SCL | 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 |

**Note:** Ta = -30 to 70 ℃, IOVCC = 1.65V to 3.6V, VCI = 2.5V to 3.6V, AGND = DGND = 0V, T = 10+/-0.5ns



## 4-wrie SPI system

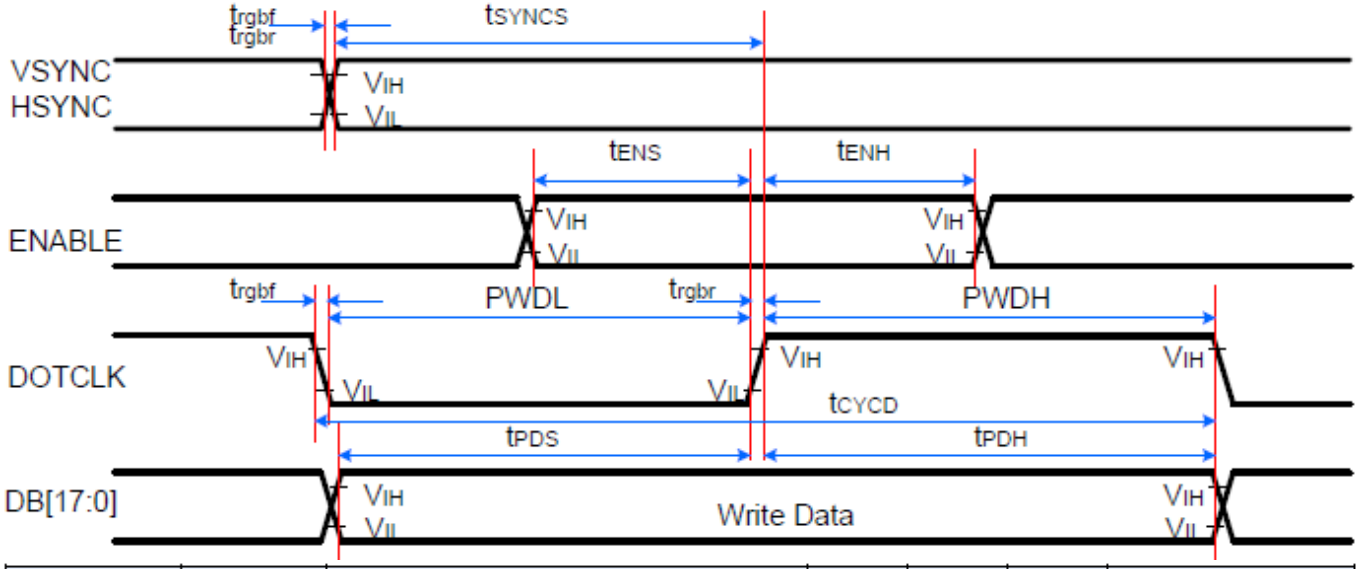



| Signal | Symbol | Parameter | min | max | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | tcss | Chip select time (Write) | 15 | - | ns | |
| | tcsh | Chip select hold time (Read) | 15 | - | ns | |
| | tCHW | CS H pulse width | 40 | - | ns | |
| SCL | twc | Serial clock cycle (Write) | 50 | - | ns | |
| | twrh | SCL H pulse width (Write) | 10 | - | ns | |
| | twrl | SCL L pulse width (Write) | 10 | - | ns | |
| | trc | Serial clock cycle (Read) | 150 | - | ns | |
| | trdh | SCL H pulse width (Read) | 60 | - | ns | |
| | trdl | SCL L pulse width (Read) | 60 | - | ns | |
| D/CX | tas | D/CX setup time | 10 | - | ns | |
| | tah | D/CX hold time (Write/Read) | 10 | - | 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 For minimum CL=8pF |
| | tod | Output disable time (Read) | 15 | 50 | ns | |

**Notes:**

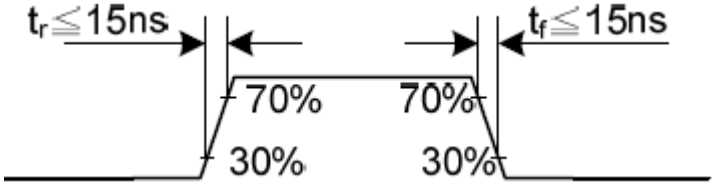
1. Ta = -30 to 70 ℃, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V, T = 10+/-0.5ns.
2. Does not include signal rising and falling times.

## 7.4 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 | |

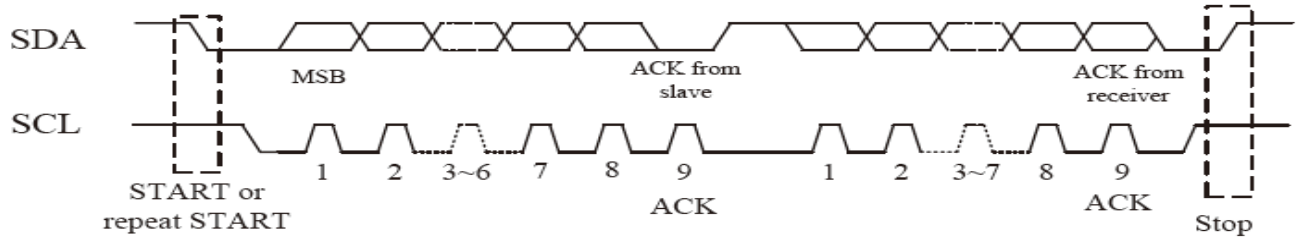
**Note:** Ta = -30 to 70 ℃, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V



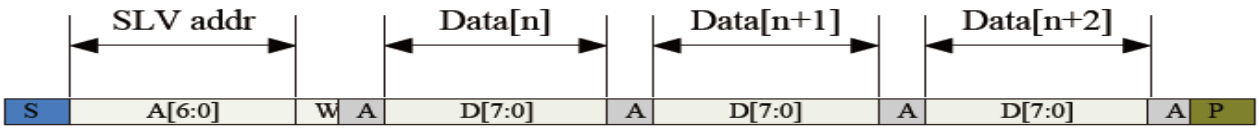
## 7.5 CTP Timing characteristics

### 7.5.1 Serial Interface

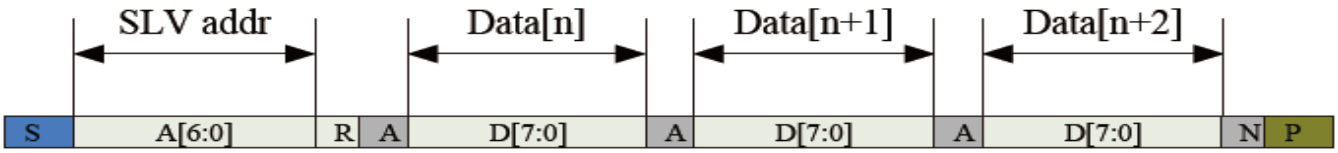
#### $I^2C$




*I2C Serial Data Transfer Format*




*I2C master write, slave read*




*I2C master read, slave write*

Table 2-1 lists the meanings of the mnemonics used in the above figures.

**Mnemonics Description**

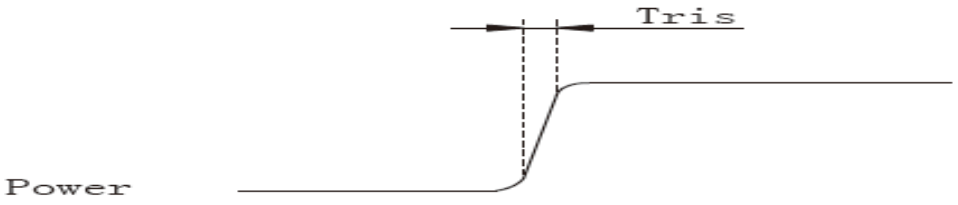
| Mnemonics | Description |
|---|---|
| S | I2C Start or I2C Restart |
| A[6:0] | Slave address |
| R/W | READ/WRITE bit, '1' for read, '0'for write |
| A(N) | ACK(NACK) |
| P | STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the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

I2C Interface Timing Characteristics is shown in Table 2-2.

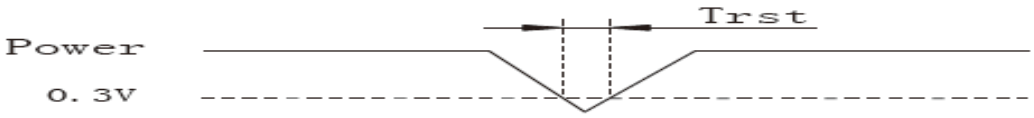
**I2C Timing Characteristics**

| Parameter | Min | Max | Unit |
|---|---|---|---|
| SCL frequency | 10 | 400 | KHz |
| Bus free time between a STOP and START condition | 4.7 | \ | us |
| Hold time (repeated) START condition | 4.0 | \ | us |
| Data setup time | 250 | \ | ns |
| Setup time for a repeated START condition | 4.7 | \ | us |
| Setup Time for STOP condition | 4.0 | \ | us |

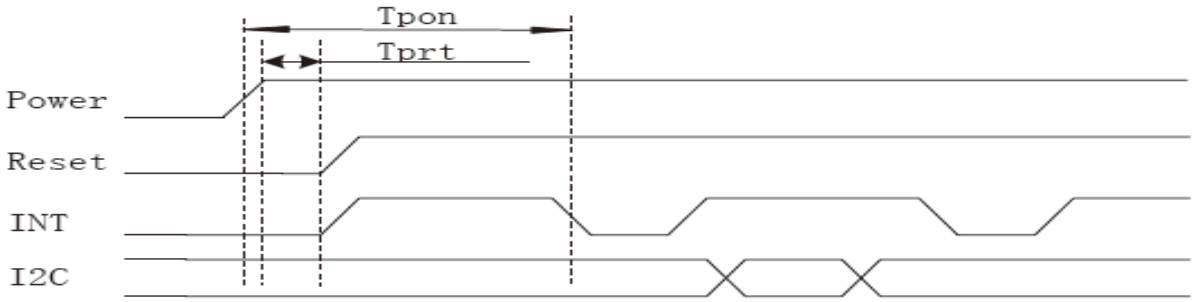
### 7.5.2 POWER NO /Reset/Wake Sequence




*Power on time*

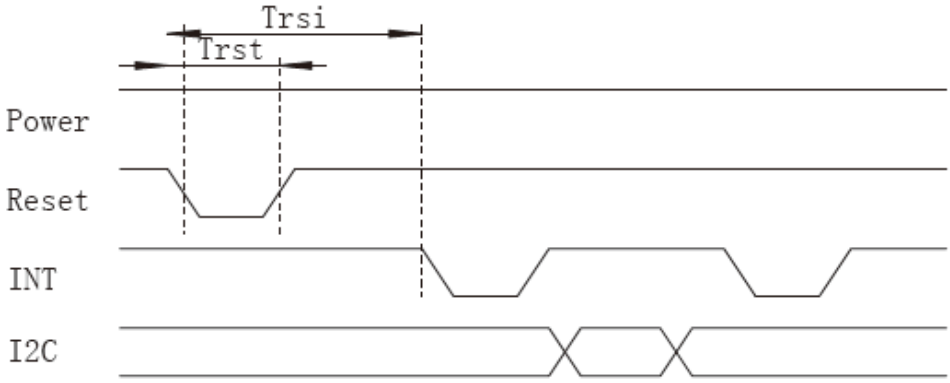



*Power Cycle requirement*




*Power on Sequence*

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.




*Reset Sequence*

## 8. Backlight Characteristics

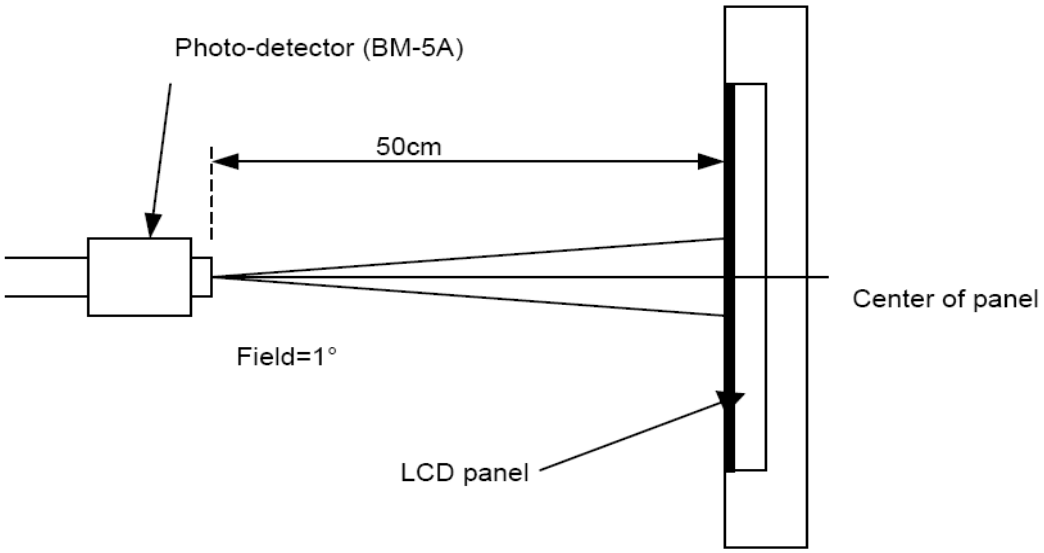

**BL CIRCUIT DIAGRAM**

| Item | Symbol | MIN | TYP | MAX | UNIT | Test Condition |
|---|---|---|---|---|---|---|
| Supply Voltage | Vf | 16.8 | 19.2 | 21 | V | If=20mA |
| Supply Current | If | - | 20 | - | mA | - |
| Luminous Intensity for LCM | - | 200 | 250 | - | $cd/m^2$ | If=20mA |
| Uniformity for LCM | - | 80 | - | - | % | If=20mA |
| Life Time | - | - | 50000 | - | Hr | If=20mA |
| Backlight Color | White | | | | | |

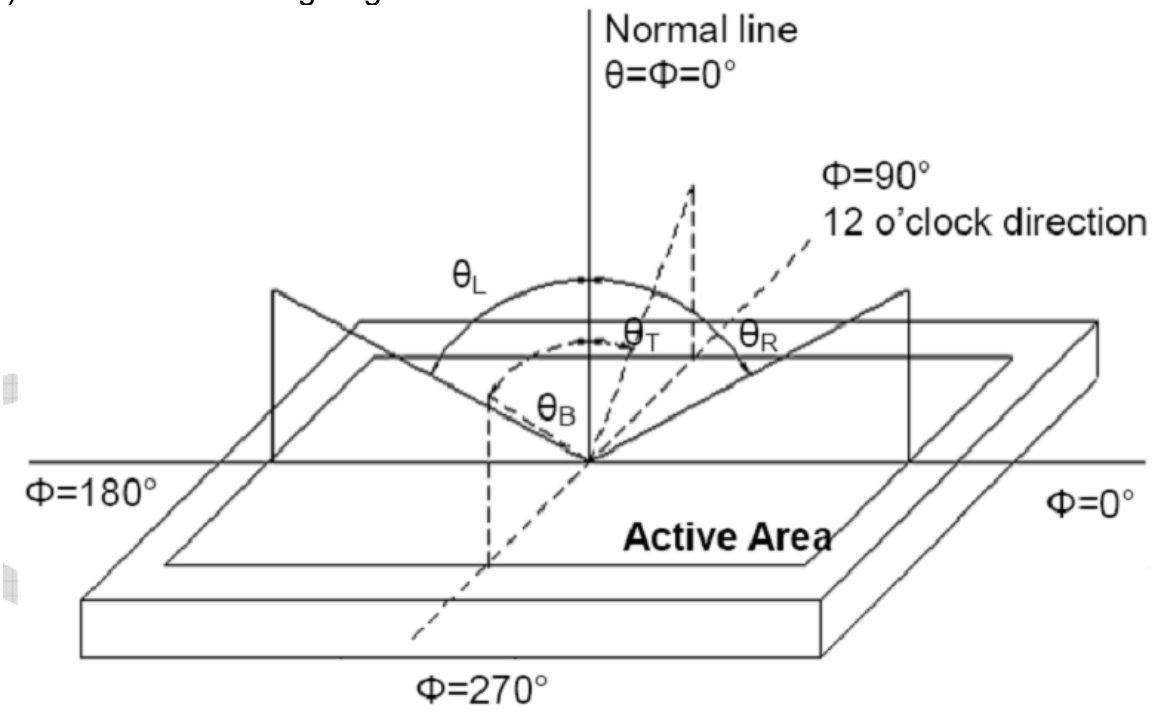
## 9. Optical Characteristics

| Item | Conditions | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Viewing Angle (CR>10) | Horizontal | $\theta_L$ | - | 80 | - | degree | (1),(2),(6) |
| | | $\theta_R$ | - | 80 | - | | |
| | Vertical | $\theta_T$ | - | 80 | - | | |
| | | $\theta_B$ | - | 80 | - | | |
| Contrast Ratio | Center | | - | 700 | - | - | (1),(3),(6) |
| Response Time | Rising + Falling | | - | 30 | - | ms | (1),(4),(6) |
| 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



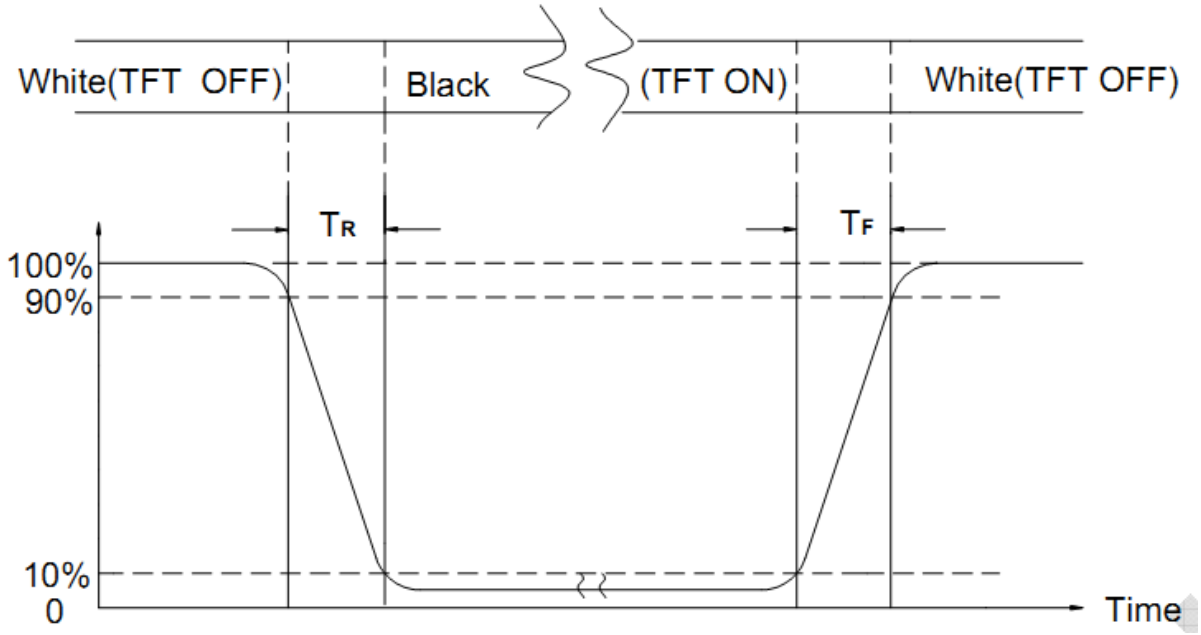

Note (3) Definition Of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

Contrast Ratio (CR) = L63 / L0

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)

Transmittance = Center Luminance of LCD / Center Luminance of Back Light x 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 |
|---|---|---|---|
| □ | High Temperature Storage | 80°C±2°C×96Hours | 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. |
| □ | Low Temperature Storage | -30°C±2°C×96Hours | |
| □ | High Temperature Operating | 70°C±2°C×96Hours | |
| □ | Low Temperature Operating | -20°C±2°C×96Hours | |
| □ | Temperature Cycle(Storage) | -20°C ⟺ 25°C ⟺ 70°C<br>(30min) (5min) (30min)<br>1cycle<br>Total 10cycle | |
| □ | Damp Proof Test (Storage) | 50°C±5°C×90%RH×96Hours | |
| □ | Vibration Test | Frequency:10Hz~55Hz~10Hz<br>Amplitude:1.5MM<br>X,Y,Z direction for total 3hours<br>(packing condition test will be tested by a carton) | |
| □ | Drooping Test | Drop to the ground from 1M height one time<br>every side of carton.<br>(packing condition test will be tested by a carton) | |
| □ | 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. Inspection Standard

11.1. QUALITY :

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

11.1.1. 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.

11.1.2. 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 SINGLE PLAN.

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

11.1.3. 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

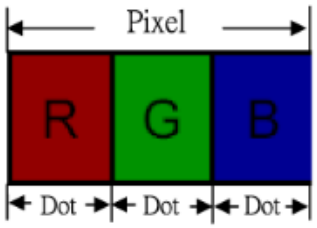
11.2.1.CHECKING DIRECTION SHALL BE IN THE 45 DEGREE AREA TO FACE THE SAMPLE.

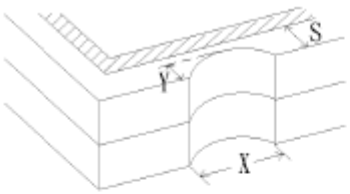
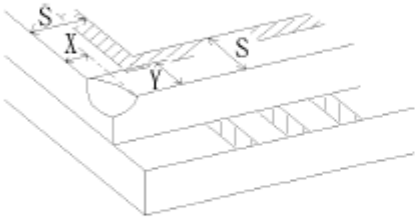
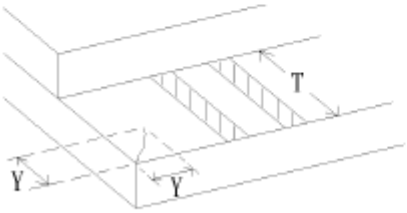
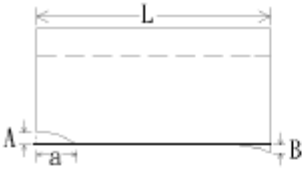
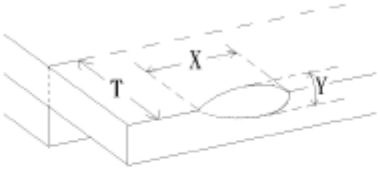
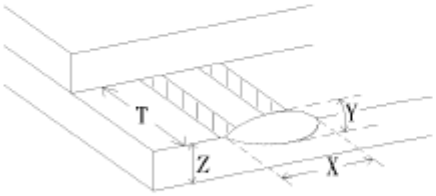
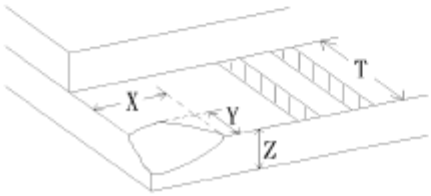
11.2.2.CHECKER SHALL SEE OVER 300±25 mm. WITH BARE EYES FAR FROM SAMPLE AND USING 2 PCS. OF 20W FLUORESCENT LAMP.

11.3. INSPECTION PLAN :

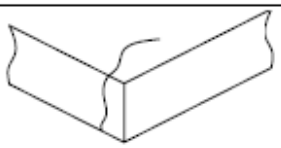
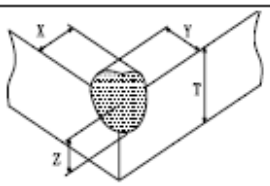
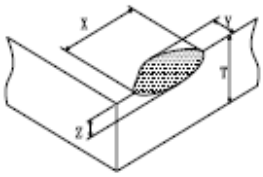
| CLASS | ITEM | JUDGEMENT | CLASS |
|---|---|---|---|
| PACKING & INDICATE | 1. OUTSIDE AND INSIDE PACKAGE | "MODEL NO." , "LOT NO." AND "QUANTITY" SHOULD INDICATE ON THE PACKAGE. | Minor |
| | 2. MODEL MIXED AND QUANTITY | OTHER MODEL MIXED.....REJECTED QUANTITY SHORT OR OVER.....REJECTED | Critical |
| | 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 AREA .....REJECTED | 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、CHARACTER ....REJECTED | 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 |

## 11.4. STANDARD OF VISUAL INSPECTION

| NO. | CLASS | ITEM | JUDGEMENT |
|---|---|---|---|
| 11.4.1 | MINOR | BLACK AND WHITE SPOT<br>FOREIGN MATERIEL<br>DUST IN THE CELL<br>BLEMISH<br>SCRATCH | (A) ROUND TYPE: unit : mm.<br>DIAMETER (mm.) / ACCEPTABLE Q'TY<br>Φ ≦ 0.1 / DISREGARD<br>0.1 < Φ ≦ 0.25 / 3 (Distance>5mm)<br>0.25 < Φ / 0<br>NOTE: Φ=(LENGTH+WIDTH)/2<br>(B) LINEAR TYPE: unit : mm.<br>LENGTH / WIDTH / ACCEPTABLE Q'TY<br>------ / W ≦0.03 / DISREGARD<br>L ≦ 5.0 / 0.03 < W ≦0.07 / 3 (Distance>5mm)<br>------ / 0.07 < W / FOLLOW ROUND TYPE |
| 11.4.2 | MINOR | BUBBLE IN POLARIZER<br>DENT ON POLARIZER | unit : mm.<br>DIAMETER / ACCEPTABLE Q'TY<br>Φ ≦ 0.2 / DISREGARD<br>0.2 < Φ ≦ 0.5 / 2 (Distance>5mm)<br>0.5 < Φ / 0 |
| 11.4.3 | MINOR | Dot Defect | Items / ACC. Q'TY<br>Bright dot / N≦ 4<br>Dark dot / N≦ 4<br>Pixel Define :  <br>Note 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.<br>Note 2: Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.<br>Note 3: Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green ,blue pattern. |

| NO. | CLASS | ITEM | JUDGEMENT |
|---|---|---|---|
| 11.4.4 | MINOR | LCD GLASS CHIPPING |   Y > S<br>Reject |
| 11.4.5 | MINOR | LCD GLASS CHIPPING |   X or Y > S<br>Reject |
| 11.4.6 | MAJOR | LCD GLASS GLASS CRACK |   Y > (1/2) T<br>Reject |
| 11.4.7 | MAJOR | LCD GLASS SCRIBE DEFECT |   1. a> L/3 , A>1.5mm.<br>Reject<br>2. B : ACCORDING TO DIMENSION |
| 11.4.8 | MINOR | LCD GLASS CHIPPING ( ON THE TERMINAL AREA ) |   Φ= (x+y)/2 > 2.5 mm<br>Reject |
| 11.4.9 | MINOR | LCD GLASS CHIPPING ( ON THE TERMINAL SURFACE ) |   Y > (1/3) T<br>Reject |
| 11.4.10 | MINOR | LCD GLASS CHIPPING |   Y > T<br>Reject |

11.5 INSPECTION STANDARD OF TOUCH PANEL

| NO. | CLASS | ITEMS | | JUDGEMENT | |
|---|---|---|---|---|---|
| 11.5.1 | MAJOR | Touch Panel Crack | |  | Reject |
| 11.5.2 | MINOR | Touch Panel Chipping | Corner |  X≦2mm, Y≦2mm, Z<1/2T | Accept |
| | | | Edge |  X≦3mm, Y≦3mm, Z<1/2T | Accept |
| 11.5.3 | MINOR | Scratch Dust and Foreign materiel (Linear Type) | | W≦0.05, L≦20mm | Accept |
| | | | | 0.05mm<W≦0.07mm: L≦10.0mm Distance between seratch>5.0mm | Accept 3 ea Max. |
| | | | | W>0.07mm | Reject |
| 11.5.4 | MINOR | Scratch Dust and Foreign materiel (Round Type: Φ=(Length+Width)/2) | | Φ≦0.25mm | Accept |
| | | | | 0.25mm<Φ≦0.35mm Distance between spots>5.0mm | Accept 5 ea Max. |
| | | | | Φ>0.35mm | Reject |
| 11.5.5 | MINOR | Touch Panel Dent / Fish Eyes | | Φ≦0.35mm | Accept |
| | | | | 0.35mm<Φ≦1.0mm Distance>5.0mm | Accept 3 ea Max. |
| | | | | Φ>1.0mm | Reject |
| 11.5.6 | MINOR | Touch Panel Air Bubble | | Φ≦0.2mm | Accept |
| | | | | 0.2mm<Φ≦0.5mm Distance between bubbles>5.0mm | Accept 3 ea Max. |
| | | | | Φ>0.5mm | Reject |
| 11.5.7 | MINOR | Touch Panel Printing area Scratch | | W≦0.05mm, L≦5mm Distance between scratch>5.0mm | Accept 3 ea Max. |
| | | | | W>0.05mm or L>5mm ( W>0.05 Follow 11.5.4 Round type ) | Reject |
| 11.5.8 | MINOR | Touch Panel White Haze Mark / Dust | | Can not be removed | Reject |

# 12. Handling Precautions

## 12.1 Mounting method

The LCD panel of AMSON TFT module consists of two thin glass plates with polarizes which easily be damaged. And since the module in 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 happen 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 use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to power or GND, 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 then 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 then the operating temperature range and on the other hand at higher temperature LCD's how 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**