



## ASI-T-7001B4MPN/B Ver C

| Item              |            | Specification                | Unit   |
|-------------------|------------|------------------------------|--------|
| Outline Dimension |            | 103.46x162.5x2.45(Typ.)      | mm     |
| Display area      |            | 94.2(H) x 150.72(V)          | mm     |
| Number of Pixel   |            | 800 RGB(H) x 1280 (V)        | pixels |
| Pixel pitch       |            | 0.11775(H) x 0.11775(V)      | mm     |
| Pixel arrangement |            | RGB Vertical stripe          |        |
| Display mode      |            | IPS, Normally Black          |        |
| Surface treatment |            | Antiglare, Hard-Coating(3H)  |        |
| Weight            |            | 88 (Typ.)                    | g      |
| Back-light        |            | Single LED (Side-Light type) |        |
| Power Consumption | B/L System | 1.5(Max.)                    | w      |





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# 1. General description

## 1.1 Introduction

ASI-T-7001B4MPN/B is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device.

This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 7.0 inch diagonally measured active display area with WXGA (800 horizontal by 1280 vertical pixel) resolution.

## 1.2 Features

7.0 inch configuration

4wire MIPI interface

LED Backlight

RoHS Compliance

## 1.3 Applications

Mobile

Personal Navigation Device

Multimedia applications and Others AV system

## 1.4 General information

| Item              | Specification                | Unit   |
|-------------------|------------------------------|--------|
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| Pixel arrangement | RGB Vertical stripe          |        |
| Display mode      | IPS, Normally Black          |        |
| Surface treatment | Antiglare, Hard-Coating(3H)  |        |
| Weight            | 88 (Typ.)                    | g      |
| Back-light        | Single LED (Side-Light type) |        |
| Power Consumption | B/L System<br>1.5(Max.)      | w      |

## 1.5 Mechanical Information

| item        | Min.          | Typ.   | Max.   | Unit   |    |
|-------------|---------------|--------|--------|--------|----|
| Module Size | Horizontal(H) | 103.26 | 103.46 | 103.66 | mm |
|             | Vertical(V)   | 162.30 | 162.50 | 162.50 | mm |
|             | Depth(D)      | 2.35   | 2.45   | 2.55   | mm |

## 2.0 ABSOLUTE MAXIMUM RATINGS

### 2.1 Electrical Absolute Rating

#### 2.1.1 TFT LCD Module

| Item                     | Symbol | Min. | Max.    | Unit. | Note  |
|--------------------------|--------|------|---------|-------|-------|
| Power supply voltage     | VCI    | -0.3 | 3.6     | V     | GND=0 |
| Logic Signal Input Level | VCC    | -0.3 | VCI+0.3 | V     |       |

#### 2.1.2 Back-Light Unit

| Item                      | Symbol | MIN. | TYP. | Max. | Unit | Note |
|---------------------------|--------|------|------|------|------|------|
| Current of Backlight Unit | Ib     | --   | 80   | --   | mA   |      |
| Voltage of Backlight Unit | Vb     | --   | 15   | 16.5 | V    |      |

**Note:**

Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

### 2.2 Environment Absolute Rating

| Item                  | Symbol | Min. | Max. | Unit | Remarks |
|-----------------------|--------|------|------|------|---------|
| Operating Temperature | Topa   | -20  | +70  | °C   |         |
| Storage Temperature   | Tstg   | -30  | +80  | °C   |         |

### 3.0 OPTICAL CHARACTERISTICS

#### 3.1 Optical specification:

| Item                              | Symbol   | Temp.        | Min.                                   | Typ. | Max.                                                                 | Unit    | Condition                                                     |
|-----------------------------------|----------|--------------|----------------------------------------|------|----------------------------------------------------------------------|---------|---------------------------------------------------------------|
| Response Time                     | Tr+Tf    | 25°C         |                                        | 30   | 35                                                                   | msec    | $\theta = 0^\circ, \phi = 0^\circ$ (Note 1,3)                 |
| Contrast Rate                     | Cr       | 25°C         | 600                                    | 800  | --                                                                   | --      | $\theta = 0^\circ, \phi = 0^\circ$ LED:ON, LIGHT:OFF(Note1,2) |
| Brightness                        | YL       | 25°C         | 400                                    | 450  |                                                                      | Cd/m2   | (IL=80mA)(Note1,4)                                            |
| Visual angle range front and rear | $\theta$ | 25°C         | ( $\theta_L$ ) 85<br>( $\theta_R$ ) 85 |      |                                                                      | De-gree | $\phi = 0^\circ, CR \geq 10$ LED:ON LIGHT:OFF(Note 1,4)       |
| Visual angle range left and right | $\theta$ | 25°C         | ( $\theta_U$ ) 85<br>( $\theta_D$ ) 85 |      |                                                                      | De-gree | $\phi = 90^\circ, CR \geq 10$ LED:ON LIGHT:OFF(Note 1,4)      |
| Brightness uniformity             | BUNI     |              | 80                                     |      |                                                                      | %       | $\Theta = 0$ (Note5,7)                                        |
| Visual angle                      |          |              | all                                    |      |                                                                      |         | (Note 6)                                                      |
| Item                              | Symbol   | Transmissive |                                        |      | Conditions                                                           |         |                                                               |
|                                   |          | Min.         | Typ.                                   | Max. |                                                                      |         |                                                               |
| Red                               | XR       |              |                                        |      | Reference:<br>LCD Panel,<br>CIE (x, y)<br>chromaticity<br>(Note 1,4) |         |                                                               |
|                                   | YR       |              |                                        |      |                                                                      |         |                                                               |
| Green                             | XG       |              |                                        |      |                                                                      |         |                                                               |
|                                   | YG       |              |                                        |      |                                                                      |         |                                                               |
| Blue                              | XB       |              |                                        |      |                                                                      |         |                                                               |
|                                   | YB       |              |                                        |      |                                                                      |         |                                                               |
| White                             | XW       | 0.27         | 0.31                                   | 0.35 |                                                                      |         |                                                               |
|                                   | YW       | 0.29         | 0.32                                   | 0.36 |                                                                      |         |                                                               |

#### 3.2 Measuring Condition

Measuring surrounding: dark room ,LED current IL : 80mA

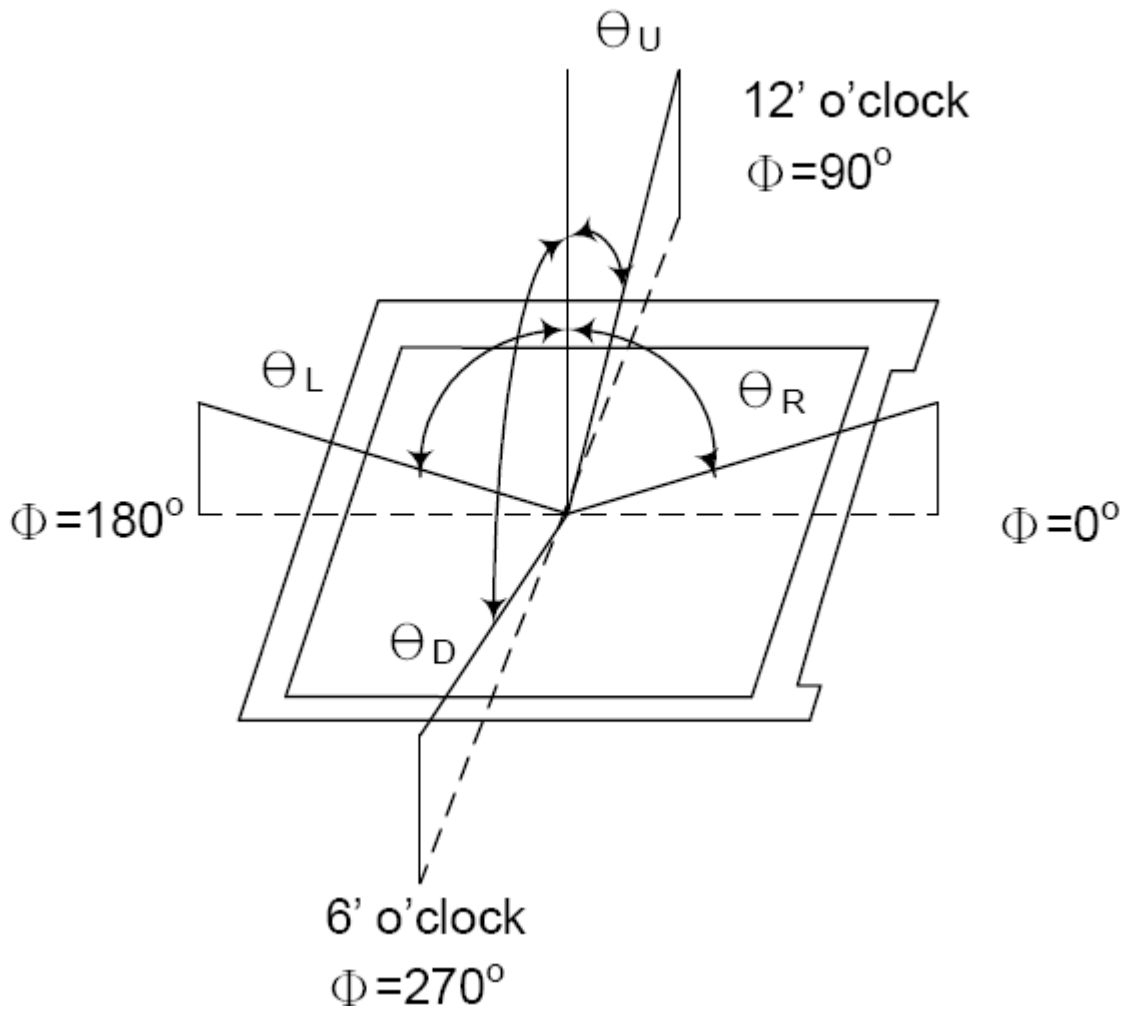
Ambient temperature: 25±2°C

15min. warm-up time.

#### 3.3 Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. Measuring spot size: 20 ~ 21 mm

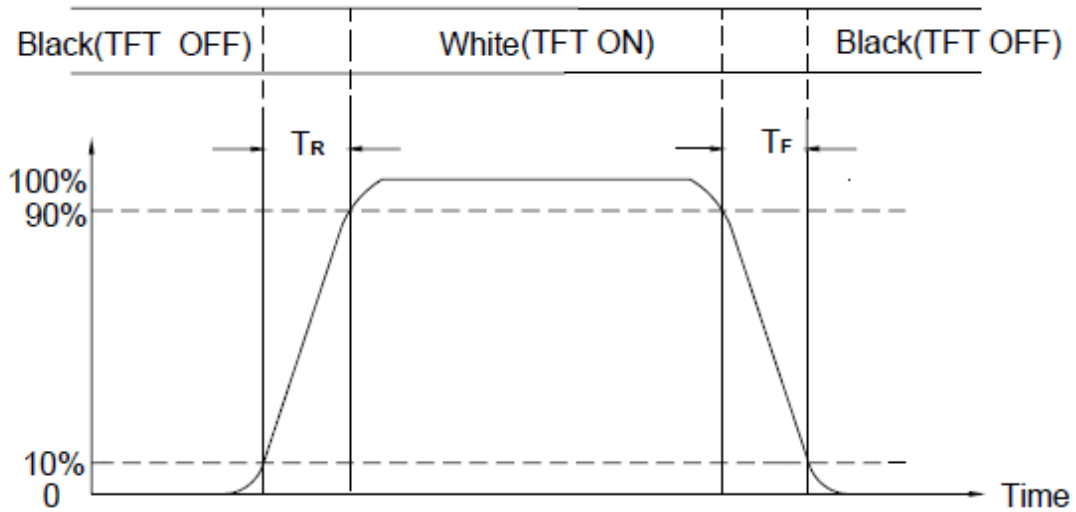
Note (1) Definition of Viewing Angle :



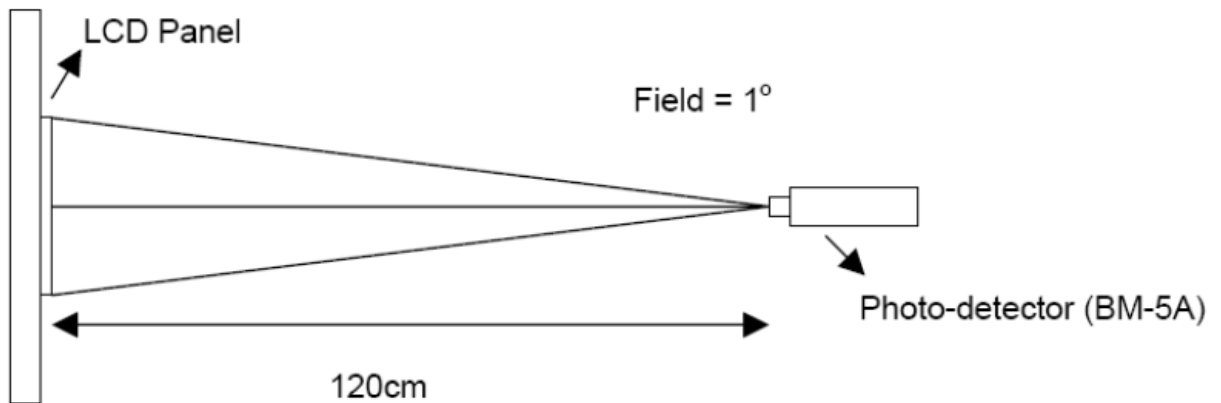
**Note (2) Definition of Contrast Ratio (CR):**  
**Measured at the center point of panel**

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

**Note (3) Definition of Response Time: Sum of TR and TF**

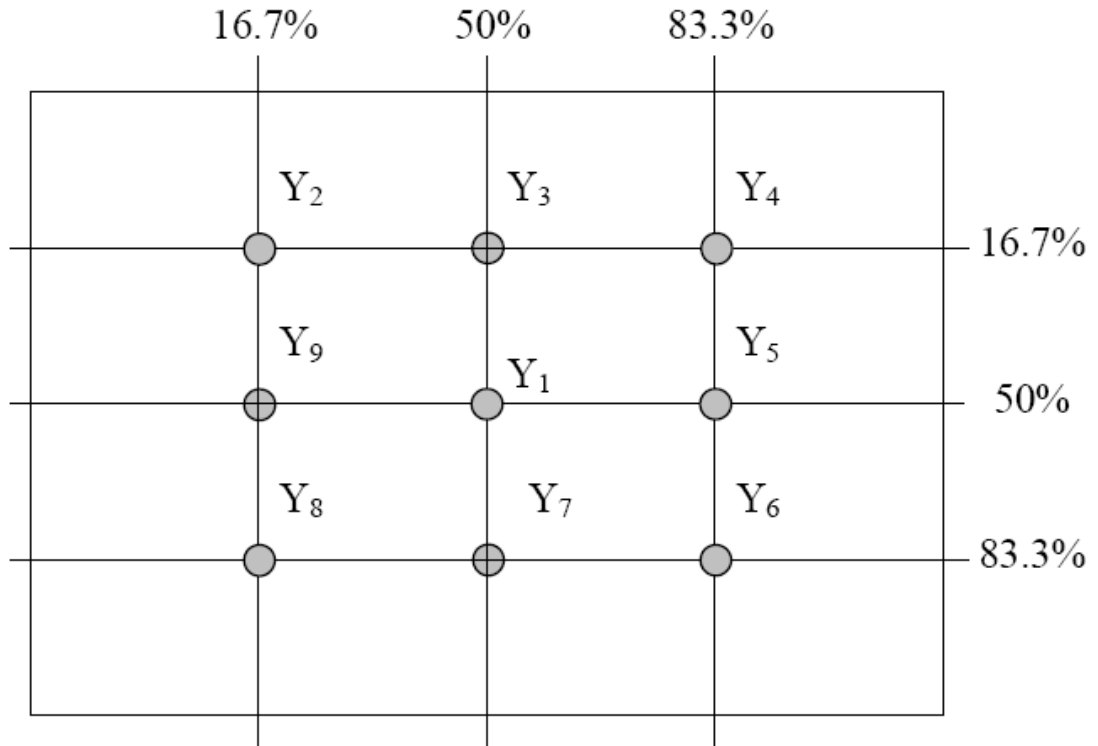


**Note (4) Definition of optical measurement setup**





**Note (5) Definition of brightness uniformity**



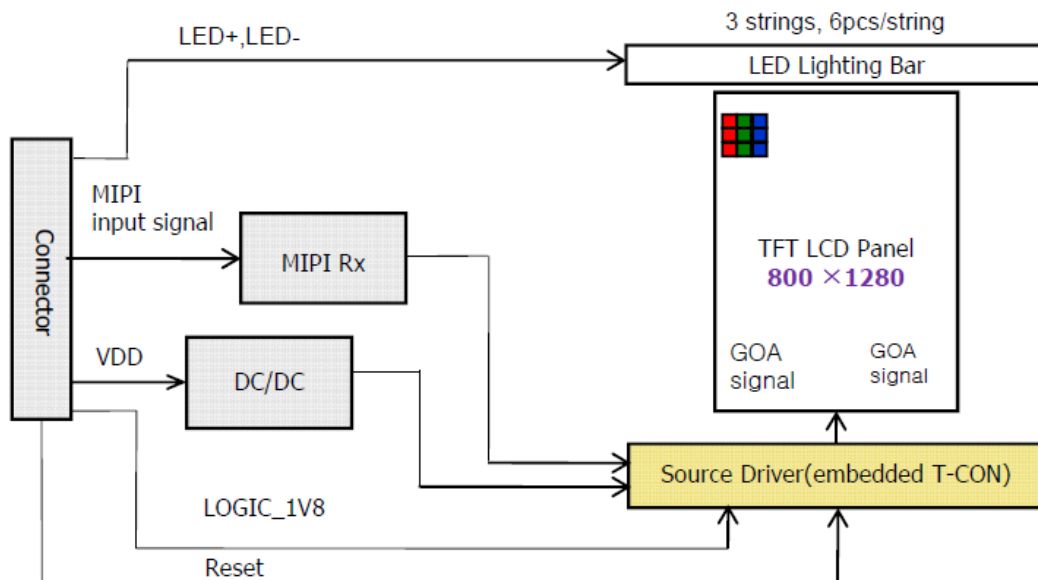
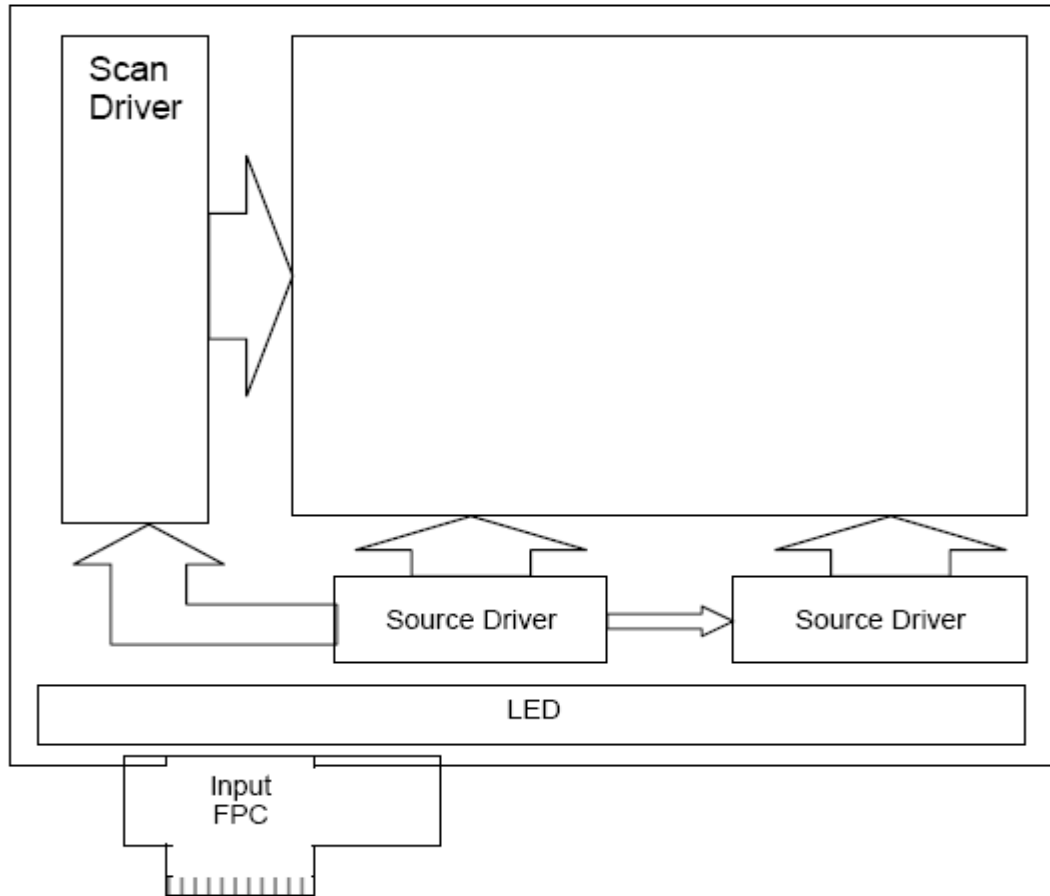
$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

**Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction).**

**Note (7) Measured at the brightness of the panel when all terminals of LCD panel are electrically open.**

## 4.0 BLOCK DIAGRAM

### 4.1 TFT LCD Module



## 5.0 INTERFACE PIN CONNECTION

### 5.1 TFT LCD ModuleCN (Input signal): FPC Down Connector, (FH33J-40S-0.5H (10) (HIROSE), 40pin,pitch = 0.5mm)

| Terminal No. | Symbol   | I/O | Functions                        |
|--------------|----------|-----|----------------------------------|
| 1            | NC       | —   | NC                               |
| 2            | VDDIN    | P   | Power input 3.3 Voltage          |
| 3            | VDDIN    | P   | Power input 3.3 Voltage          |
| 4            | GND      | P   | Power Ground                     |
| 5            | RST      | I   | Global reset signal,low active   |
| 6            | NC       | -   | No connection                    |
| 7            | GND      | P   | Power Ground                     |
| 8            | MIPI_0N  | I   | MIPI DSI differential data pair  |
| 9            | MIPI_0P  | I   | MIPI DSI differential data pair  |
| 10           | GND      | P   | Power Ground                     |
| 11           | MIPI_1N  | I   | MIPI DSI differential data pair  |
| 12           | MIPI_1P  | I   | MIPI DSI differential data pair  |
| 13           | GND      | P   | Power Ground                     |
| 14           | MIPI_CKN | I   | MIPI DSI differential CLK pair   |
| 15           | MIPI_CKP | I   | MIPI DSI differential CLK pair   |
| 16           | GND      | P   | Power Ground                     |
| 17           | MIPI_2N  | I   | MIPI DSI differential data pair  |
| 18           | MIPI_2P  | I   | MIPI DSI differential data pair  |
| 19           | GND      | P   | Power Ground                     |
| 20           | MIPI_3N  | I   | MIPI DSI differential data pair  |
| 21           | MIPI_3P  | I   | MIPI DSI differential data pair  |
| 22           | GND      | P   | Power Ground                     |
| 23           | NC       | -   | No connection                    |
| 24           | NC       | -   | No connection                    |
| 25           | GND      | P   | Power Ground                     |
| 26           | NC       | -   | No connection                    |
| 27           | PWMO     | O   | PWM control signal for BL driver |
| 28           | NC       | -   | No connection                    |
| 29           | VCL      | O   | Output voltage pin               |
| 30           | GND      | P   | Power Ground                     |
| 31           | LED-     | P   | Power for LED backlight negative |
| 32           | LED-     | P   | Power for LED backlight negative |

|    |       |   |                               |
|----|-------|---|-------------------------------|
| 33 | NC    | - | No connection                 |
| 34 | NC    | - | No connection                 |
| 35 | NC    | - | NC                            |
| 36 | NC    | - | No connection                 |
| 37 | NC    | - | No connection                 |
| 38 | NC    | - | NC                            |
| 39 | VLED+ | P | Power for LED backlight anode |
| 40 | VLED+ | P | Power for LED backlight anode |

**Note (1):** Be sure to apply the power voltage as the power sequence spec.

**Note (2):** DGND=AGND=0V

## 6.0 ELECTRICAL CHARACTERISTICS

### 6.1 TFT LCD Module

| Parameter               | Symbol | Min     | Typ | Max     | Unit |
|-------------------------|--------|---------|-----|---------|------|
| Supply Voltage          | VDDIN  | 3.0     | 3.3 | 3.6     | V    |
|                         | Ivddin |         | NA  |         | mA   |
| Input voltage 'H' level | VIH    | 0.7 VDD | -   | VCI     | V    |
| Input voltage 'L' level | VIL    | 0       | -   | 0.3 VDD | V    |

## 6.2 Back-Light Unit

The backlight system is an edge-lighting type with 20 LED.

The characteristics of the LED are shown in the following tables.

| Item                    | Symbol | Min.  | Typ. | Max. | Unit | Note   |
|-------------------------|--------|-------|------|------|------|--------|
| LED current             | IL     | -     | 80   | -    | mA   | (2)    |
| LED Voltage             | VL     | -     | 15   | 16.5 | V    |        |
| Operating LED life time | Hr     | 50000 | -    | -    | Hour | (1)(2) |

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition:  $T_a=25\pm 3\text{ }^\circ\text{C}$ , typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at  $T_a=25^\circ\text{C}$  and  $IL=80\text{mA}$ . The LED lifetime could be decreased if operating IL is larger than 80mA. The constant current driving method is suggested.

## 6.3 AC Characteristics

### 6.3.1: High Speed mode-clock channel timing

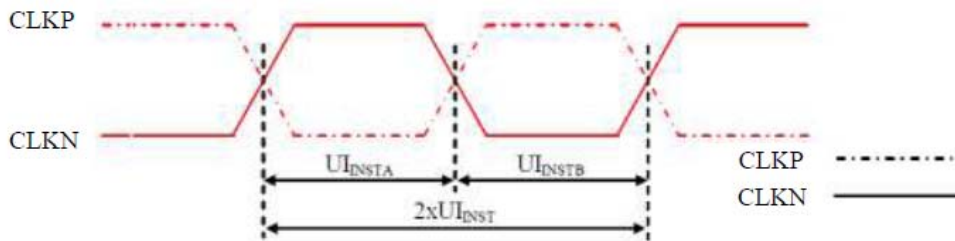


Figure 116: DSI Clock Channel Timing

Table 38: DSI Clock Channel Timing

| Signal | Symbol                               | Parameter               | Min    | Max  | Unit |
|--------|--------------------------------------|-------------------------|--------|------|------|
| CLKP/N | $2xUI_{INST}$                        | Double UI instantaneous | Note 2 | 25   | ns   |
| CLKP/N | $UI_{INSTA}, UI_{INSTB}$<br>(Note 1) | UI instantaneous Half   | Note 2 | 12.5 | ns   |

**Notes:**

- $UI = UI_{INSTA} = UI_{INSTB}$
- Define the minimum value, see Table 39.

Table 39: Limited Clock Channel Speed

| Data type                                                   | Two Lanes speed | Three Lanes speed | Four Lanes speed |
|-------------------------------------------------------------|-----------------|-------------------|------------------|
| Data Type = 00 1110 (0Eh), RGB 666, 16 UI per Pixel         | 566 Mbps        | 466 Mbps          | 366 Mbps         |
| Data Type = 01 1110 (1Eh), RGB 666, 18 UI per Pixel         | 637 Mbps        | 525 Mbps          | 412 Mbps         |
| Data Type = 10 1110 (2Eh), RGB 666 Loosely, 24 UI per Pixel | 850 Mbps        | 700 Mbps          | 550 Mbps         |
| Data Type = 11 1110 (3Eh), RGB 888, 24 UI per Pixel         | 850 Mbps        | 700 Mbps          | 550 Mbps         |

### High Speed Mode – Data Clock Channel Timing

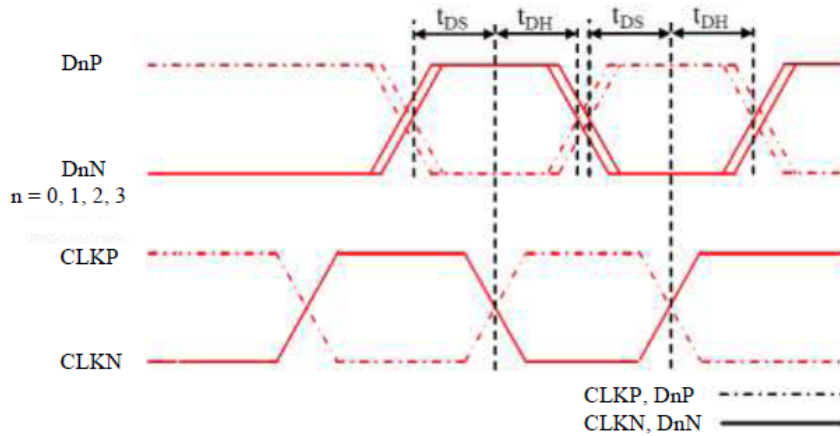


Figure 117: DSI Data to Clock Channel Timings

Table 40: DSI Data to Clock Channel Timings

| Signal            | Symbol   | Parameter                | Min     | Max |
|-------------------|----------|--------------------------|---------|-----|
| DnP/N , n=0 and 1 | $t_{DS}$ | Data to Clock Setup time | 0.15xUI | -   |
|                   | $t_{DH}$ | Clock to Data Hold Time  | 0.15xUI | -   |

### High Speed Mode – Rising and Falling Timings

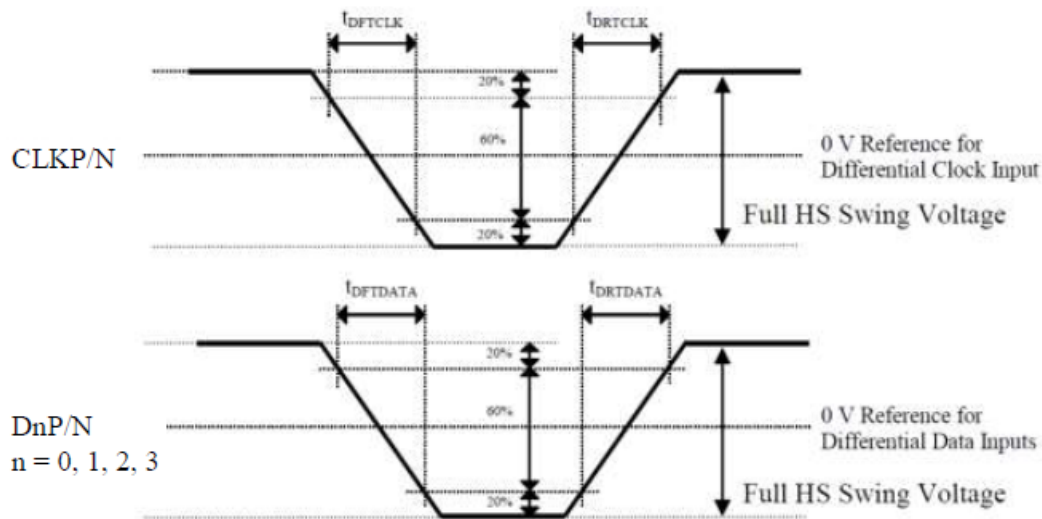


Figure 118: Rising and Falling Timings on Clock and Data Channels

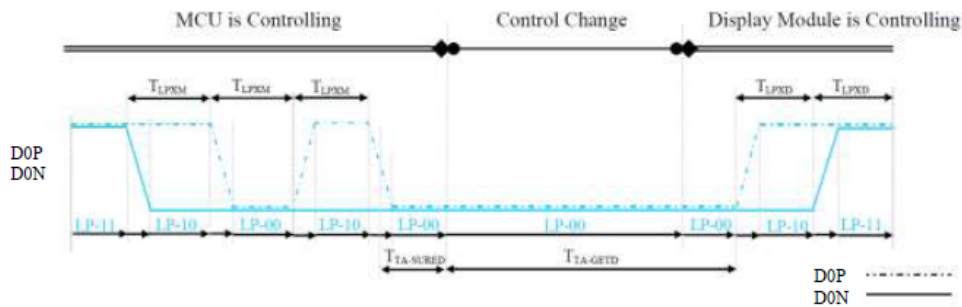
**Table 41: Rise and Fall Timings on Clock and Data Channels**

| Parameter                        | Symbol       | Condition              | Specification |     |              |
|----------------------------------|--------------|------------------------|---------------|-----|--------------|
|                                  |              |                        | Min           | Typ | Max          |
| Differential Rise Time for Clock | $t_{DRCLK}$  | CLKP/N                 | 150 ps        | -   | 0.3UI (Note) |
| Differential Rise Time for Data  | $t_{DRDATA}$ | DnP/N<br>$n=0$ and $1$ | 150 ps        | -   | 0.3UI (Note) |
| Differential Fall Time for Clock | $t_{DFCLK}$  | CLKP/N                 | 150 ps        | -   | 0.3UI (Note) |
| Differential Fall Time for Data  | $t_{DFDATA}$ | DnP/N<br>$n=0$ and $1$ | 150 ps        | -   | 0.3UI (Note) |

**Note:** The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-Phy standard.

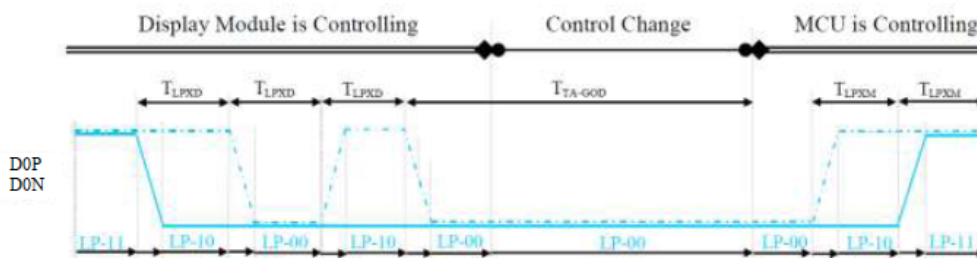
### 6.3.2: Low Speed mode-Bus Turn Around

Lower Power Mode and its State Periods on the Bus Turnaround (BTA) from the MCU to the Display Module (ILI9881C) are illustrated for reference purposes below.



**Figure 119: BTA from the MCU to the Display Module**

Lower Power Mode and its State Periods on the Bus Turnaround (BTA) from the Display Module (ILI9881C) to the MCU are illustrated for reference purposes below.



**Table 42: Low Power State Period Timings – A**

| Signal | Symbol         | Description                                                                       | Min        | Max                 | Unit |
|--------|----------------|-----------------------------------------------------------------------------------|------------|---------------------|------|
| DOP/N  | $T_{LPXM}$     | Length of LP-00, LP-01, LP-10 or LP-11 periods<br>MCU → Display Module (ILI9881C) | 50         | 75                  | ns   |
| DOP/N  | $T_{LPXD}$     | Length of LP-00, LP-01, LP-10 or LP-11 periods<br>Display Module (ILI9881C) → MCU | 50         | 75                  | ns   |
| DOP/N  | $T_{TA-SURED}$ | Time-out before the Display Module (ILI9881C) starts driving                      | $T_{LPXD}$ | $2 \times T_{LPXD}$ | ns   |

**Table 43: Low Power State Period Timings – B**

| Signal | Symbol        | Description                                        | Time                | Unit |
|--------|---------------|----------------------------------------------------|---------------------|------|
| DOP/N  | $T_{TA-GETD}$ | Time to drive LP-00 by Display Module (ILI9881C)   | $5 \times T_{LPXD}$ | ns   |
| DOP/N  | $T_{TA-GOD}$  | Time to drive LP-00 after turnaround request - MCU | $4 \times T_{LPXD}$ | ns   |

### Data Lanes from Low Power Mode to High Speed Mode

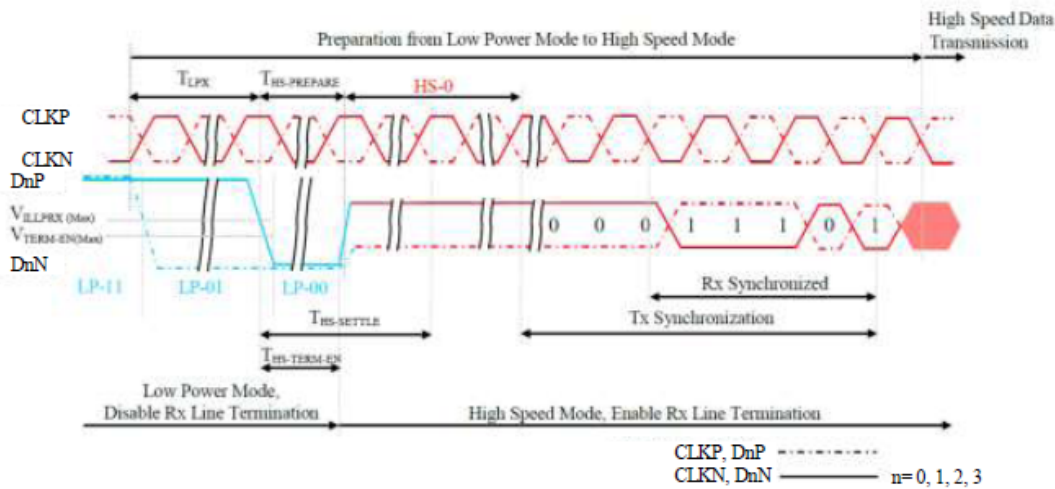


Figure 121: Data Lanes - Low Power Mode to High Speed Mode Timings

Table 44: Data Lanes - Low Power Mode to High Speed Mode Timings

| Signal             | Symbol           | Description                                                                             | Min       | Max       | Unit |
|--------------------|------------------|-----------------------------------------------------------------------------------------|-----------|-----------|------|
| DnP/N, n = 0 and 1 | $T_{LPX}$        | Length of any Low Power State Period                                                    | 50        | -         | ns   |
| DnP/N, n = 0 and 1 | $T_{HS-PREPARE}$ | Time to drive LP-00 to prepare for HS Transmission                                      | $40+4xUI$ | $85+6xUI$ | ns   |
| DnP/N, n = 0 and 1 | $T_{HS-TERM-EN}$ | Time to enable Data Lane Receiver line termination measured from when Dn crosses VILMAX | -         | $35+4xUI$ | ns   |

### 6.3.3: Data Lanes from High Speed to Low Speed mode

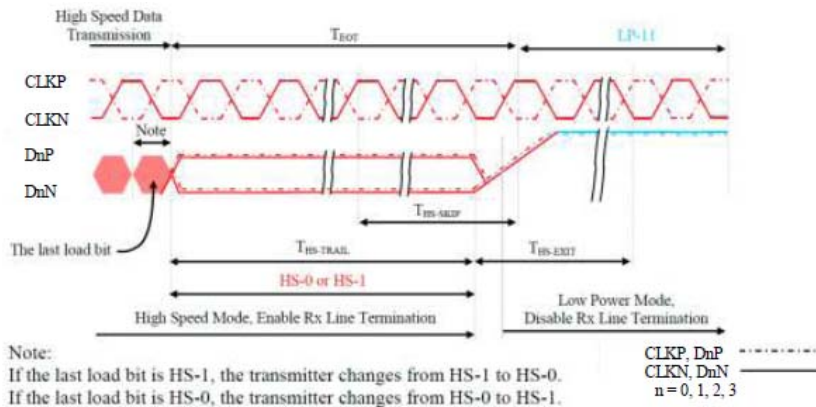


Figure 122: Data Lanes - High Speed Mode to Low Power Mode Timings

Table 45: Data Lanes - High Speed Mode to Low Power Mode Timings

| Signal             | Symbol        | Description                                                             | Min | Max       | Unit |
|--------------------|---------------|-------------------------------------------------------------------------|-----|-----------|------|
| DnP/N, n = 0 and 1 | $T_{HS-SKIP}$ | Time-Out at Display Module (IL9881C) to ignore transition period of EoT | 40  | $55+4xUI$ | ns   |
| DnP/N, n = 0 and 1 | $T_{HS-EXIT}$ | Time to driver LP-11 after HS burst                                     | 100 | -         | ns   |



### 6.3.4:DSI Clock Burst- High Speed mode to/from Low Speed mode

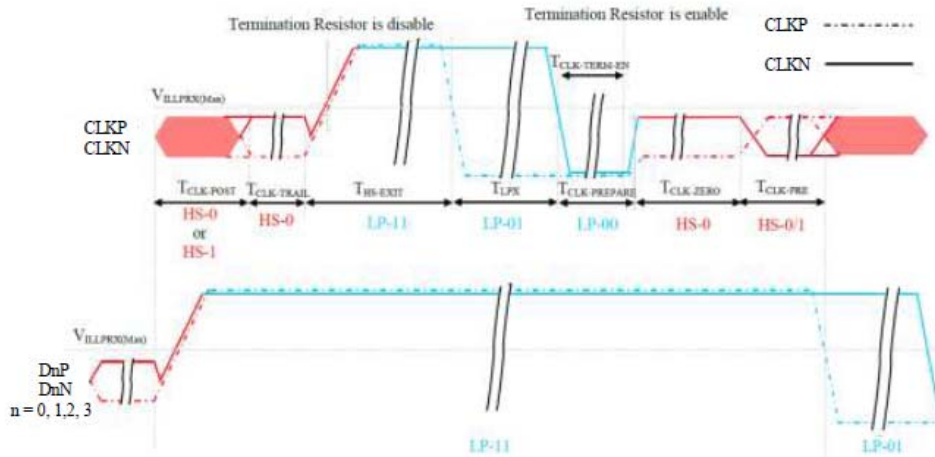


Figure 123: Clock Lanes - High Speed Mode to/from Low Power Mode Timings

Table 46: Clock Lanes - High Speed Mode to/from Low Power Mode Timings

| Signal | Symbol                           | Description                                                                                                          | Min        | Max | Unit |
|--------|----------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|-----|------|
| CLKP/N | $T_{CLK-POST}$                   | Time that the MCU shall continue sending HS clock after the last associated Data Lanes has transitioned to LP mode   | $60+52xUI$ | -   | ns   |
| CLKP/N | $T_{CLK-TRAIL}$                  | Time to drive HS differential state after last payload clock bit of a HS transmission burst                          | 60         | -   | ns   |
| CLKP/N | $T_{HS-EXIT}$                    | Time to drive LP-11 after HS burst                                                                                   | 100        | -   | ns   |
| CLKP/N | $T_{CLK-PREPARE}$                | Time to drive LP-00 to prepare for HS transmission                                                                   | 38         | 95  | ns   |
| CLKP/N | $T_{CLK-TERM-EN}$                | Time-out at Clock Lane to enable HS termination                                                                      | -          | 38  | ns   |
| CLKP/N | $T_{CLK-PREPARE} + T_{CLK-ZERO}$ | Minimum lead HS-0 drive period before starting Clock                                                                 | 300        | -   | ns   |
| CLKP/N | $T_{CLK-PRE}$                    | Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode | $8xUI$     | -   | ns   |

### 6.3.5:Reset Timing

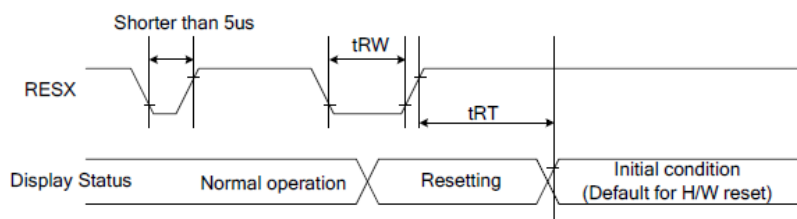


Figure 124: Reset Timing

Table 47: Reset Timing

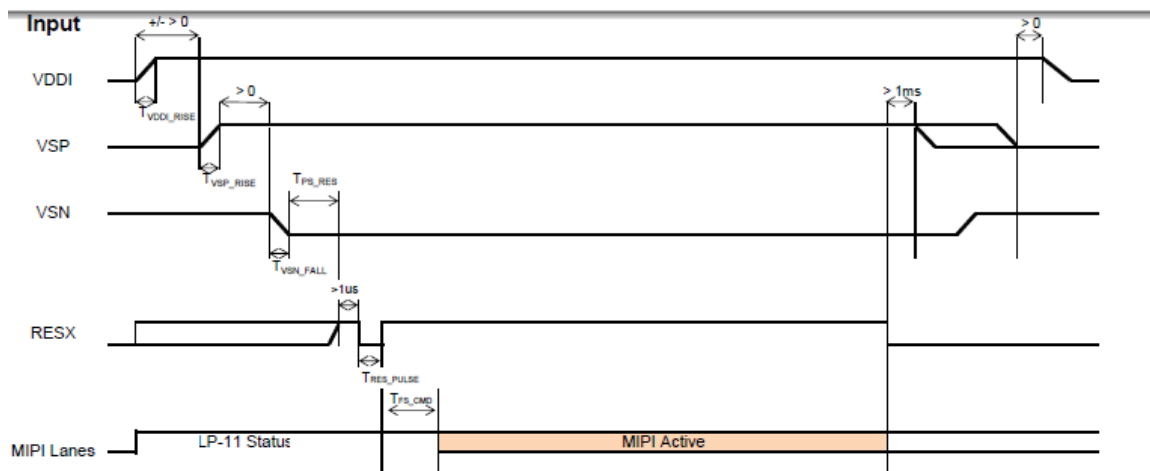
| Signal | Symbol | Parameter            | Min | Max                              | Unit |
|--------|--------|----------------------|-----|----------------------------------|------|
| RESX   | tRW    | Reset pulse duration | 10  |                                  | uS   |
|        | tRT    | Reset cancel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

**Notes:**

- The reset cancel also includes required time for loading ID bytes, VCOM setting and other settings from EEPROM to registers. This loading is done every time when there is H/W reset cancel time (tRT) within 5 ms after a rising edge of RESX.
- Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the Table 48.

## 6.4: Power on/off Sequence

### 6.4.1: Powermode 2A

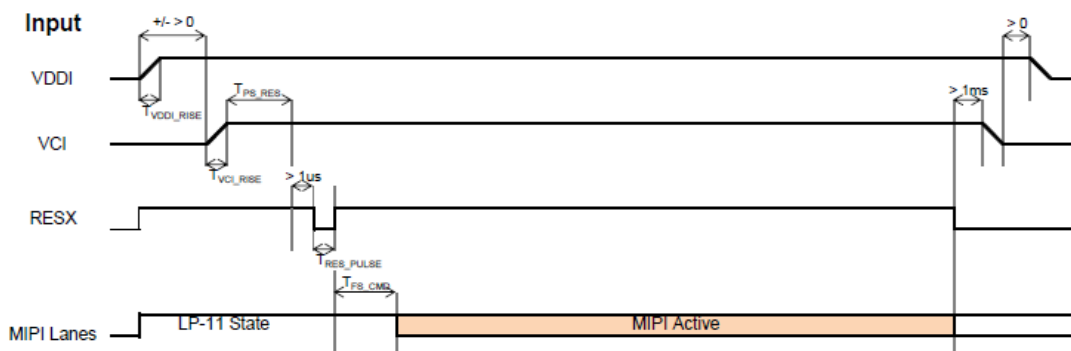


| Symbol           | Characteristics           | Min. | Typ. | Max. | Units |
|------------------|---------------------------|------|------|------|-------|
| $T_{VDDI\_RISE}$ | VDDI Rise time            | 10   | -    | -    | us    |
| $T_{VSP\_RISE}$  | VSP Rise time             | 130  | -    | -    | us    |
| $T_{VSN\_FALL}$  | VSN Fall time             | 200  | -    | -    | us    |
| $T_{PS\_RES}$    | VDDI/VSP on to Reset high | 5    | -    | -    | ms    |
| $T_{RES\_PULSE}$ | Reset low pulse time      | 10   | -    | -    | us    |
| $T_{FS\_CMD}$    | Reset to first command    | 10   | -    | -    | ms    |

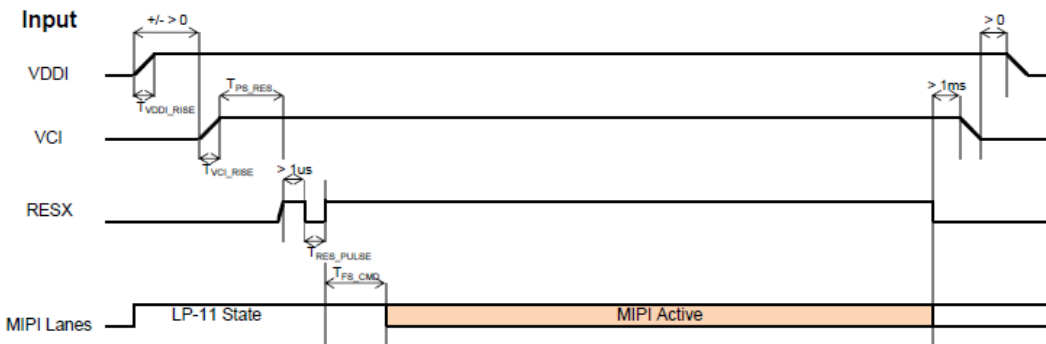
Figure 104: Power on/off sequence with Power Mode 2A

### 6.4.2: Power mode 3

Case A:



**Case B:**

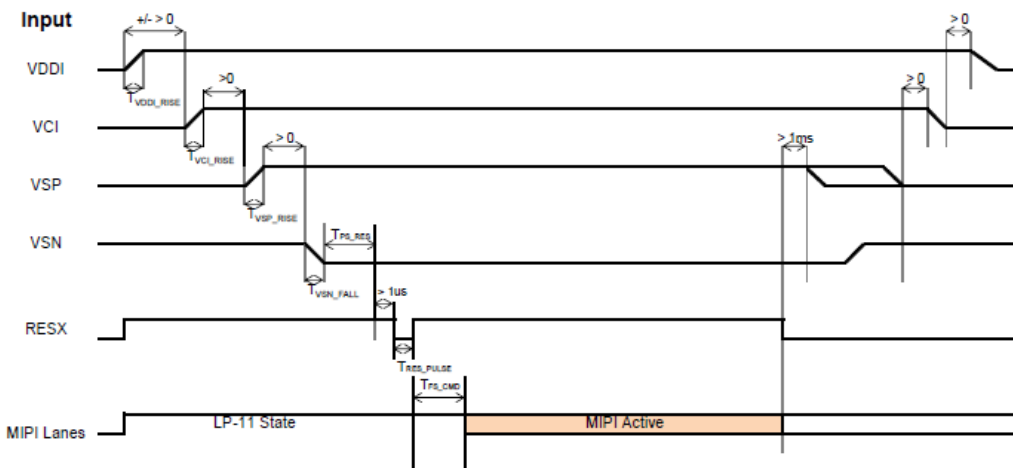


| Symbol           | Characteristics           | Min. | Typ. | Max. | Units |
|------------------|---------------------------|------|------|------|-------|
| $T_{VDDI\_RISE}$ | VDDI Rise time            | 10   | -    | -    | us    |
| $T_{VCI\_RISE}$  | Case A: VCI Rise time     | 130  | -    | -    | us    |
|                  | Case B: VCI Rise time     | 40   | -    | -    | us    |
| $T_{PS\_RES}$    | VDDI/VCI on to Reset high | 5    | -    | -    | ms    |
| $T_{RES\_PULSE}$ | Reset low pulse time      | 10   | -    | -    | us    |
| $T_{FS\_CMD}$    | Reset to first command    | 10   | -    | -    | ms    |

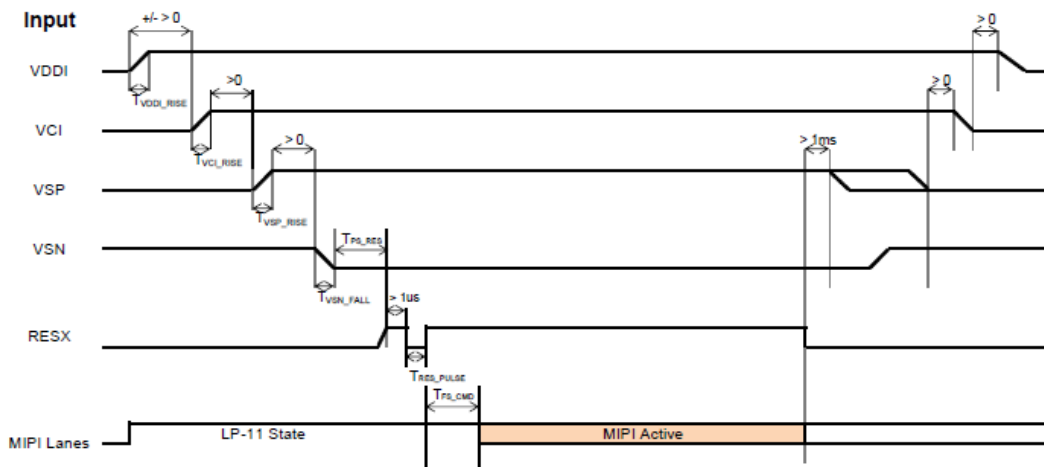
Figure 105: Power on/off sequence with Power Mode 3

### 6.4.3: Power mode 4

**Case A**



**Case B**



| Symbol           | Characteristics           | Min. | Typ. | Max. | Units |
|------------------|---------------------------|------|------|------|-------|
| $T_{VDDI\_RISE}$ | VDDI Rise time            | 10   | -    | -    | us    |
| $T_{VCI\_RISE}$  | Case A: VCI Rise time     | 130  | -    | -    | us    |
|                  | Case B: VCI Rise time     | 40   | -    | -    | us    |
| $T_{VSP\_RISE}$  | VSP Rise time             | 130  | -    | -    | us    |
| $T_{VSN\_FALL}$  | VSN Fall time             | 200  | -    | -    | us    |
| $T_{PS\_RES}$    | VDDI/VCI on to Reset high | 5    | -    | -    | ms    |
| $T_{RES\_PULSE}$ | Reset low pulse time      | 10   | -    | -    | us    |
| $T_{FS\_CMD}$    | Reset to first command    | 10   | -    | -    | ms    |

Figure 106: Power on/off sequence with Power Mode 4

**Power Flow Chart**

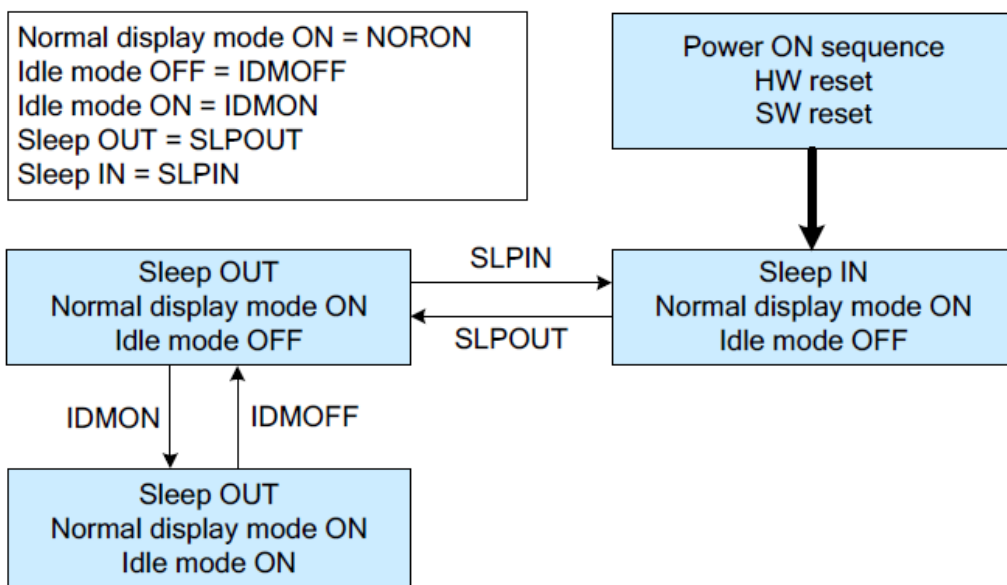
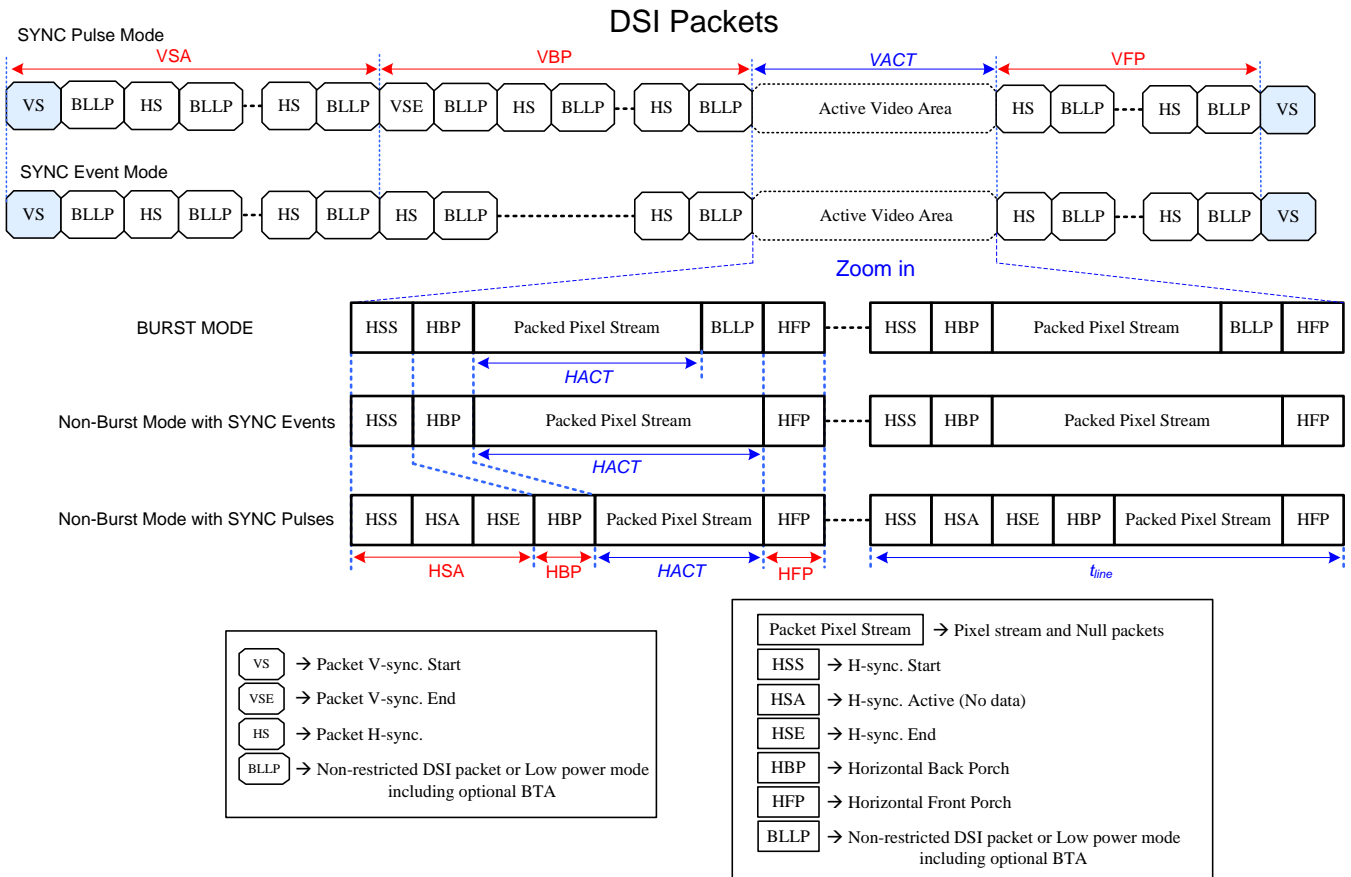


Figure 1075: Power Mode Flow Chart



| Parameters              | Symbols           | Min.        | Typ. | Max.   | Units     |
|-------------------------|-------------------|-------------|------|--------|-----------|
| Vertical sync. active   | VSA               | 2 (Note 6)  | -    | -      | Line      |
| Vertical Back Porch     | VBP               | 14 (Note 6) | -    | -      | Line      |
| Vertical Front Porch    | VFP               | 8 (Note 6)  | -    | -      | Line      |
| Active lines per frame  | VACT              | -           | 1280 | -      | Line      |
| Horizontal sync. active | HSA               | 2           | -    | -      | Pixel     |
| Horizontal Porch period | HSA + HBP + HFP   | 1.6         | -    | -      | us        |
| Active pixels per line  | HACT              | -           | 720  | -      | Pixel     |
| Bit rate                | BR <sub>bps</sub> | 385         |      | Note 5 | Mbps/lane |

1 UI=1/Bit rate

$$HSA(\text{pixel}) = (tHSA \times \text{lane number}) / (UI \times \text{pixel format})$$

$$HBP(\text{pixel}) = (tHBP \times \text{lane number}) / (UI \times \text{pixel format})$$

$$HFP(\text{pixel}) = (tHFP \times \text{lane number}) / (UI \times \text{pixel format})$$

$$\text{Frame Rate} = \frac{BR_{\text{bps}} \times \text{Lane}_{\text{num}}}{(VACT + VSA + VBP + VFP) \times (HACT + HSA + HBP + HFP) \times \text{Pixel Format}}$$

Example : BR<sub>bps</sub> = 457Mbps/lane, 1UI=2.1883ns, Frame rate=60Hz, VACT=1280, VSA=2, VBP=30, VFP=20, HACT=720, HSA=33, HBP=100, HFP=100, Lane<sub>num</sub>=4(lane), Pixel Format=24(bit).

**7.0 Reliability test items**

| NO. | Item                                          | Conditions                                                                                                                                                            | Remark                                                                                                                                                                                                                                                              |
|-----|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | High Temperature Storage                      | Ta=+80°C,240hrs                                                                                                                                                       | <b>Inspection</b><br>after 2~4 hours storage at room temperature, the sample shall be free from defects<br>1. Air bubble in the LCD<br>2. Sealleak<br>3. non-display<br>4. missing segments<br>5. glass crack<br>6. current idd is twice higher than initial value. |
| 2   | Low Temperature Storage                       | Ta=-30°C,240hrs                                                                                                                                                       |                                                                                                                                                                                                                                                                     |
| 3   | High Temperature Operation                    | Ta=+70°C,240hrs                                                                                                                                                       |                                                                                                                                                                                                                                                                     |
| 4   | Low Temperature Operation                     | Ta=-20°C,240hrs                                                                                                                                                       |                                                                                                                                                                                                                                                                     |
| 5   | High Temperature and High Humidity(Operation) | Ta=+60°C, 90%RH, 240hrs                                                                                                                                               |                                                                                                                                                                                                                                                                     |
| 6   | Thermal cycling Test (non operation)          | -20°C(30min)→+70°C(30min),100cycles                                                                                                                                   |                                                                                                                                                                                                                                                                     |
| 7   | Electrostatic discharge                       | 200V 200pf(0ohm) 1time/each terminal                                                                                                                                  |                                                                                                                                                                                                                                                                     |
| 8   | Vibration                                     | 1. Random:<br>1.04 Grms,5~500HZ,<br>X/Y/Z,30min/each direction<br>2. Sine:<br>Freq. Range:8~33.3hz<br>Stoke:1.3mm<br>Sweep:2.9G,33.3~400HZ<br>X/Z:2hr,Y:4hr,cyc:15min |                                                                                                                                                                                                                                                                     |
| 9   | Shock                                         | 100G,6ms,±X, ±Y, ±Z<br>3 times for each direction                                                                                                                     |                                                                                                                                                                                                                                                                     |
| 10  | Vibration( with carton)                       | Random:0.015G ^ 2/HZ, 5~200HZ<br>-6dB/octave,200~400HZ<br>XYZ each dirction:2hr                                                                                       |                                                                                                                                                                                                                                                                     |
| 11  | Drop (with carton)                            | Height:60cm<br>1 corner,3edges,6surfaces                                                                                                                              |                                                                                                                                                                                                                                                                     |

**Note:**

1. There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.
2. the test samples should be applied to only one test item
3. for damp proof test, Pure water(resistance>10M ohm)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 judged as a good part
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Charateristic, Optical Characteristic





## **9.0 GENERAL PRECAUTION**

### **9.1 Use Restriction**

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life threatening or otherwise catastrophic.

### **9.2 Disassembling or Modification**

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. All Shore does not warrant the module, if customers disassemble or modify the module.

### **9.3 Breakage of LCD Panel**

9.3.1. If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

9.3.2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

9.3.3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

9.3.4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

### **9.4 Electric Shock**

9.4.1. Disconnect power supply before handling LCD module.

9.4.2. Do not pull or fold the LED cable.

9.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

### **9.5 Absolute Maximum Ratings and Power Protection Circuit**

9.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged. 9.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time. 11.5.3. It's recommended to employ protection circuit for power supply.

### **9.6 Operation**

9.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

9.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.



**9.6.3** When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

**9.6.4** Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

**9.6.5** When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

## **9.7 Mechanism**

Please mount LCD module by using mouting holes arranged in four corners tightly.

## **9.8 Static Electricity**

**9.8.1** Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

**9.8.2.** Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

## **9.9 Strong Light Exposure**



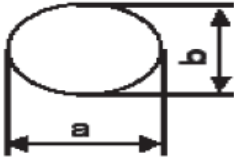
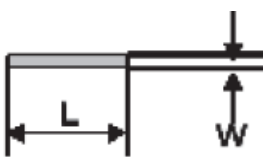
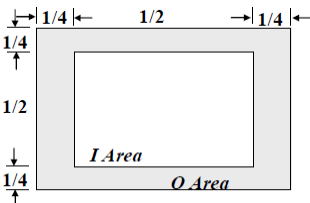
The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

## **9.10 Disposal**

When disposing LCD module, obey the local environmental regulations.

## **10. Package Specification**

**11. Visuals Specification: 1) Note**

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>General</b></p>                       | <p>1. Customer identified anomalies not defined within this inspection standard shall be reviewed by All Shore, and an additional standard shall be determined by mutual consent.</p> <p>2. This inspection standard about the image quality shall be applied to any defect within the effective viewing area and shall not be applicable to outside of the area.</p> <p>3. Inspection conditions</p> <p>Luminance : 500 Lux min.</p> <p>Inspection distance : 300 mm.</p> <p>Temperature : 25±5°C</p> <p>Direction : Directly above</p> |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Definition of inspection item</b></p> | <p><b>Dot defect</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Bright dot defect</b></p>                                                            | <p>The dot is constantly “on” when power applied to the LCD, even when all “Black” data sent to the screen. Inspection tool: 5% Transparency neutral density filter. Count dot: If the dot is visible through the filter. Don’t count dot: If the dot is not visible through the filter.</p>  <p style="text-align: right;">■ dot defect</p> |
|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>Black dot defect</b></p>                                                             | <p>The dot is constantly “off” when power applied to the LCD, even when all “White” data sent to the screen.</p>                                                                                                                                                                                                                                                                                                               |
|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>Adjacent dot</b></p>                                                                 | <p>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.</p>  <p style="text-align: right;">■ dot defect</p>                                                                                                                                                                                               |
| <p><b>External inspection</b></p>           | <p><b>Bubble ,scratch(foreign Particle polarizer, Cell, Backlight)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Visible operating (all pixels “Black” or “White”) and non operating.</p>                |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                             | <p><b>Appearance inspection</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Does not satisfy the value at the spec.</p>                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Others</b></p>                        | <p><b>LED wires</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>Damaged to the LED wires, connector, pin, functional failure or appearance failure.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Definition of Size</b></p>            | <p><b>Definition of circle :</b>  <math>d = (a + b) / 2</math></p> <p><b>definition of linear size</b> </p> <p><b>definition Area I/O</b> </p>                                                                                                                               |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |

2) Standard

| Classification        |                        | Inspection item                                                                       |               | Judgment Standard                                                                                                         |                   |  |
|-----------------------|------------------------|---------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------|-------------------|--|
| Defect (in LCD glass) | Dot defect             | <b>Area</b>                                                                           |               | <b>I</b>                                                                                                                  | <b>O</b>          |  |
|                       |                        | Bright dots(Note: Visible under:ND5%)<br>1:D≤0.15mm:No count); D>0.15mm acceptable: 2 |               | N≤0                                                                                                                       | N≤2               |  |
|                       |                        | Dark dots (0.15mm<D≤0.3mm), D>0.3mm Not allowable                                     |               | N≤3                                                                                                                       |                   |  |
|                       |                        | Bright dot-2Adjacent                                                                  |               | N≤0                                                                                                                       |                   |  |
|                       |                        | Dark dot-2Adjacent                                                                    |               | N≤0                                                                                                                       |                   |  |
|                       |                        | Dark or bright dots-3 and more adjacent(note6)                                        |               | N≤0                                                                                                                       |                   |  |
|                       |                        | Total bright and dark dots                                                            |               | N≤3                                                                                                                       |                   |  |
|                       |                        | Minimum distance between bright dots                                                  |               | 5mm                                                                                                                       |                   |  |
|                       |                        | Minimum distance between dark dots                                                    |               | 5mm                                                                                                                       |                   |  |
|                       |                        | Minimum distance between bright and bright dots                                       |               | 5mm                                                                                                                       |                   |  |
|                       | Other                  | White dot ,dark dot (circle)                                                          | Size (mm)     |                                                                                                                           | Acceptable number |  |
|                       |                        |                                                                                       | d≤0.2         |                                                                                                                           | Neglected         |  |
|                       |                        |                                                                                       | 0.2mm<D≤0.3mm |                                                                                                                           | N≤4               |  |
|                       |                        |                                                                                       | 0.3mm<D≤0.4mm |                                                                                                                           | N≤2               |  |
| D>0.4mm               |                        |                                                                                       | Not allowable |                                                                                                                           |                   |  |
| Visual defect         | Foreign partial        | <b>Circular foreign material:<br/>dark/bright sport</b>                               |               | Visible under:ND5%<br>1:D≤0.15mm:No count<br>2:0.2mm<D≤0.3mm,N≤4<br>3:D>0.3mm:Not allowable                               |                   |  |
|                       |                        | <b>Linear foreign material:<br/>bright or dark line</b>                               |               | Invisible under ND5%<br>0.1mm<W≤0.3mm,<br>0.3mm<L≤1.5mm,N≤4<br>Visible under ND5%<br>0.05mm≤w≤0.1mm,<br>0.3mm≤L≤0.7mm,N≤4 |                   |  |
|                       | Polarizer              | <b>Linear scratch</b>                                                                 |               | 1:BM:No Count<br>2:Pixel area<br>0.05mm≤w≤0.2mm,<br>1.0mm≤L≤5.0mm,N≤4                                                     |                   |  |
|                       |                        | <b>Bubble peeling</b>                                                                 |               | 1:BM:No Count<br>2:Pixel area<br>0.15mm≤D<0.3mm,N≤4                                                                       |                   |  |
|                       | <b>Mura &amp; leak</b> |                                                                                       | <b>ND5%</b>   |                                                                                                                           |                   |  |