

PRODUCT SPECIFICATION

10.2 TFT LCD MODULE  
MODEL: YDP LCD I 1020 MI



- < ◇ > Preliminary Specification
- < ◆ > Finally Specification

|                     |       |
|---------------------|-------|
| CUSTOMER'S APPROVAL |       |
| CUSTOMER :          |       |
| SIGNATURE:          | DATE: |
|                     |       |

|                                         |                                     |                |                                         |
|-----------------------------------------|-------------------------------------|----------------|-----------------------------------------|
| APPROVED<br>BY                          | PM<br>REVIEWED                      | PD<br>REVIEWED | PREPARED<br>BY                          |
| <div>TFT<br/>S. G. H<br/>20220907</div> | <div>TFT<br/>周福云<br/>20220907</div> | <div>—</div>   | <div>TFT<br/>Z. Y. J<br/>20220907</div> |



---

---

## Revision History

| Revision | Date       | Originator | Detail          | Remarks |
|----------|------------|------------|-----------------|---------|
| 1.0      | 2022.09.07 | ZYJ        | Initial Release |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |
|          |            |            |                 |         |

---

## Table of Contents

| No.   | Item                                                                | Page |
|-------|---------------------------------------------------------------------|------|
| 1.    | General Description .....                                           | 4    |
| 2.    | Module Parameter .....                                              | 4    |
| 3.    | Absolute Maximum Ratings .....                                      | 4    |
| 4.    | DC Characteristics .....                                            | 5    |
| 5.    | Backlight Characteristic .....                                      | 5    |
| 5.1.  | Backlight Characteristic .....                                      | 5    |
| 5.2.  | Backlighting circuit .....                                          | 5    |
| 6.    | Optical Characteristics .....                                       | 6    |
| 6.1.  | Optical Characteristics .....                                       | 6    |
| 6.2.  | Definition of Response Time .....                                   | 6    |
| 6.3.  | Definition of Contrast Ratio .....                                  | 7    |
| 6.4.  | Definition of Viewing Angles .....                                  | 7    |
| 6.5.  | Definition of Color Appearance .....                                | 8    |
| 6.6.  | Definition of Surface Luminance, Uniformity and Transmittance ..... | 8    |
| 7.    | Block Diagram and Power Supply .....                                | 9    |
| 8.    | Interface Pins Definition .....                                     | 10   |
| 9.    | AC Characteristics .....                                            | 11   |
| 9.1.  | MIPI AC Characteristics .....                                       | 11   |
| 9.2.  | Reset Timing .....                                                  | 19   |
| 10.   | Quality Assurance .....                                             | 20   |
| 10.1. | Purpose .....                                                       | 20   |
| 10.2. | Standard for Quality Test .....                                     | 20   |
| 10.3. | Nonconforming Analysis & Disposition .....                          | 20   |
| 10.4. | Agreement Items .....                                               | 20   |
| 10.5. | Standard of the Product Visual Inspection .....                     | 20   |
| 10.6. | Inspection Specification .....                                      | 21   |
| 10.7. | Classification of Defects .....                                     | 25   |
| 10.8. | Identification/marketing criteria .....                             | 25   |
| 10.9. | Packaging .....                                                     | 25   |
| 11.   | Reliability Specification .....                                     | 26   |
| 12.   | Precautions and Warranty .....                                      | 27   |
| 12.1. | Safety .....                                                        | 27   |
| 12.2. | Handling .....                                                      | 27   |
| 12.3. | Storage .....                                                       | 27   |
| 12.4. | Metal Pin (Apply to Products with Metal Pins) .....                 | 27   |
| 12.5. | Operation .....                                                     | 28   |
| 12.6. | Static Electricity .....                                            | 28   |
| 12.7. | Limited Warranty .....                                              | 28   |
| 13.   | Packaging .....                                                     | 29   |
| 14.   | Outline Drawing .....                                               | 30   |

---

## 1. General Description

The specification is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT-LCD panel, driver ICs and a backlight unit.

## 2. Module Parameter

| Features                        | Details                                 | Unit       |
|---------------------------------|-----------------------------------------|------------|
| Display Size(Diagonal)          | 10.2"                                   |            |
| Display Mode                    | Transmissive /Normally Black            |            |
| Resolution                      | 720 RGB × 1600                          | Pixels     |
| View Direction                  | FULL VIEW                               | Best Image |
| Module Outline                  | 116.32(H) × 248.3(V) × 2.7 (T) (Note1 ) | mm         |
| Active Area                     | 106.92(H) × 237.6(V)                    | mm         |
| Pixel Pitch                     | 148.5(H) × 148.5(V)                     | um         |
| Pixel Arrangement               | RGB Vertical Stripe                     |            |
| Display Colors                  | 16.7M                                   |            |
| Interface                       | MIPI interface                          |            |
| Driver IC                       | ICNL9707                                | -          |
| With or without the touch panel | Without                                 |            |
| Operating Temperature           | <b>-20~70</b>                           | °C         |
| Storage Temperature             | <b>-30~80</b>                           | °C         |
| Weight                          | 169                                     | g          |

Note 1: Inclusive hooks, posts, FFC/FPC tail etc.

## 3. Absolute Maximum Ratings

GND=0V, Ta=25°C

| Item                  | Symbol           | Min.       | Max.      | Unit |
|-----------------------|------------------|------------|-----------|------|
| Supply Voltage        | VCI              | -0.3       | 6.6       | V    |
|                       | VSN              | -6.6       | 0         | V    |
|                       | VSP              | -0.3       | 6.6       | V    |
|                       | IOVCC            | -0.3       | 3.3       | V    |
| Storage temperature   | T <sub>STG</sub> | <b>-30</b> | <b>80</b> | °C   |
| Operating temperature | T <sub>OP</sub>  | <b>-20</b> | <b>70</b> | °C   |

**Note 1:** If Ta below 50°C, the maximal humidity is 90%RH, if Ta over 50°C, absolute humidity should be less than 60%RH.

**Note 2:** The response time will be extremely slow when the operating temperature is around -10°C, and the back ground will become darker at high temperature operating.

## 4. DC Characteristics

| Item                             | Symbol          | Min.      | Typ. | Max.      | Unit |
|----------------------------------|-----------------|-----------|------|-----------|------|
| Supply Voltage                   | V <sub>CI</sub> | 3.0       | 3.3  | 3.6       | V    |
|                                  | V <sub>SN</sub> | -6.5      | -5.5 | -4.5      | V    |
|                                  | V <sub>SP</sub> | 4.5       | 5.5  | 6.5       | V    |
|                                  | IOVCC           | 1.65      | 1.8  | 1.95      | V    |
| Logic High level input voltage   | V <sub>IH</sub> | 0.7xIOVCC | -    | IOVCC     | V    |
| Logic Low level input voltage    | V <sub>IL</sub> | VSS       | -    | 0.3xIOVCC | V    |
| Logic High level output voltage  | V <sub>OH</sub> | 0.8xIOVCC | -    | IOVCC     | V    |
| Logic Low level output voltage   | V <sub>OL</sub> | VSS       | -    | 0.2xIOVCC | V    |
| Current Consumption<br>All White | I <sub>CC</sub> | -         | 90   | -         | mA   |

## 5. Backlight Characteristic

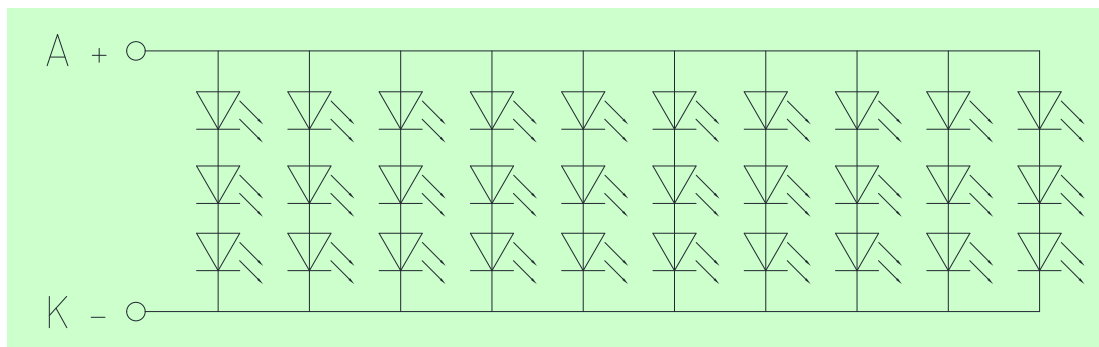
### 5.1. Backlight Characteristic

| Item              | Symbol                                                          | Condition                                       | Min. | Typ.        | Max. | Unit |
|-------------------|-----------------------------------------------------------------|-------------------------------------------------|------|-------------|------|------|
| Forward Voltage   | V <sub>F</sub>                                                  | T <sub>a</sub> =25 °C, I <sub>F</sub> =20mA/LED | 8.1  | <b>9</b>    | 9.9  | V    |
| Forward Current   | I <sub>F</sub>                                                  | T <sub>a</sub> =25 °C, V <sub>F</sub> =3.0V/LED | -    | <b>200</b>  | -    | mA   |
| Power dissipation | P <sub>D</sub>                                                  | -                                               | -    | <b>1800</b> | -    | mW   |
| Uniformity        | Avg                                                             | -                                               | -    | 80          | -    | %    |
| Drive method      | Constant current                                                |                                                 |      |             |      |      |
| LED Configuration | 30 White LEDs ( 3 LEDs in one string and 10 groups in parallel) |                                                 |      |             |      |      |

Note1: LED life time defined as follows: The final brightness is at 50% of original brightness.

The environmental conducted under ambient air flow, at T<sub>a</sub>=25±2 °C, 60%RH±5%, I<sub>F</sub>=20mA/LED.

### 5.2. Backlighting circuit



## 6. Optical Characteristics

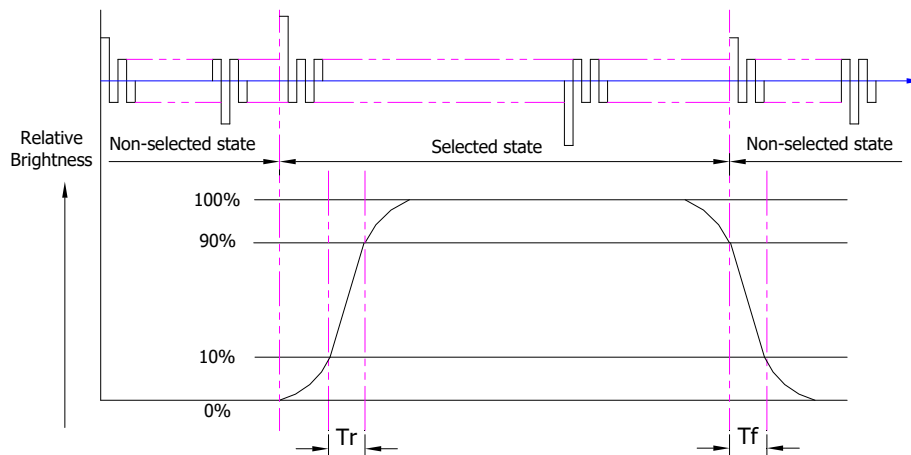
### 6.1. Optical Characteristics

Ta=25°C, VCI=3.3V, IOVCC=1.8V

| Backlight On (Transmissive Mode) | Item                                |       | Symbol       | Condition | Specification |       |       | Unit              |
|----------------------------------|-------------------------------------|-------|--------------|-----------|---------------|-------|-------|-------------------|
|                                  |                                     |       |              |           | Min.          | Typ.  | Max.  |                   |
|                                  | Luminance on TFT( $I_f$ =80mA/LED)  |       | Lv           |           | 320           | 400   | -     | cd/m <sup>2</sup> |
|                                  | Contrast ratio(See 6.3)             |       | CR           |           | 800           | 1000  | -     |                   |
|                                  | Response time (See 6.2)             |       | TR+TF        |           | -             | TBD   | -     | ms                |
|                                  | Chromaticity Transmissive (See 6.5) | Red   | XR           |           | 0.598         | 0.648 | 0.698 |                   |
|                                  |                                     |       | YR           |           | 0.291         | 0.341 | 0.391 |                   |
|                                  |                                     | Green | XG           |           | 0.265         | 0.315 | 0.365 |                   |
|                                  |                                     |       | YG           |           | 0.579         | 0.629 | 0.679 |                   |
|                                  |                                     | Blue  | XB           |           | 0.085         | 0.135 | 0.185 |                   |
| YB                               |                                     |       |              | 0.049     | 0.099         | 0.149 |       |                   |
| White                            |                                     | Xw    |              | 0.250     | 0.300         | 0.350 |       |                   |
|                                  |                                     | Yw    |              | 0.288     | 0.338         | 0.388 |       |                   |
| Viewing Angle (See 6.4)          | Horizontal                          | θX+   | Center CR≥10 | -         | 85            | -     | Deg.  |                   |
|                                  |                                     | θX-   |              | -         | 85            | -     |       |                   |
|                                  | Vertical                            | φY+   |              | -         | 85            | -     |       |                   |
|                                  |                                     | φY-   |              | -         | 85            | -     |       |                   |
| NTSC Ratio(Gamut)                |                                     |       |              | 60        | 65            | -     | %     |                   |

### 6.2. Definition of Response Time

#### 6.2.1. Normally Black Type (Negative)

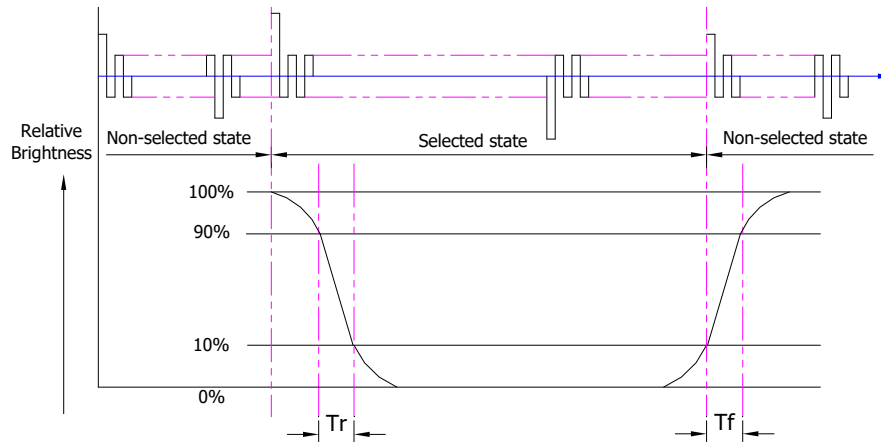


Tr is the time it takes to change from non-selected state with relative luminance 10% to selected state with relative luminance 90%;

Tf is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

Note: Measuring machine: LCD-5100

### 6.2.2. Normally White Type (Positive)



$T_r$  is the time it takes to change from non-selected state with relative luminance 90% to selected state with relative luminance 10%;

$T_f$  is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

Note: Measuring machine: LCD-5100 or EQUI

### 6.3. Definition of Contrast Ratio

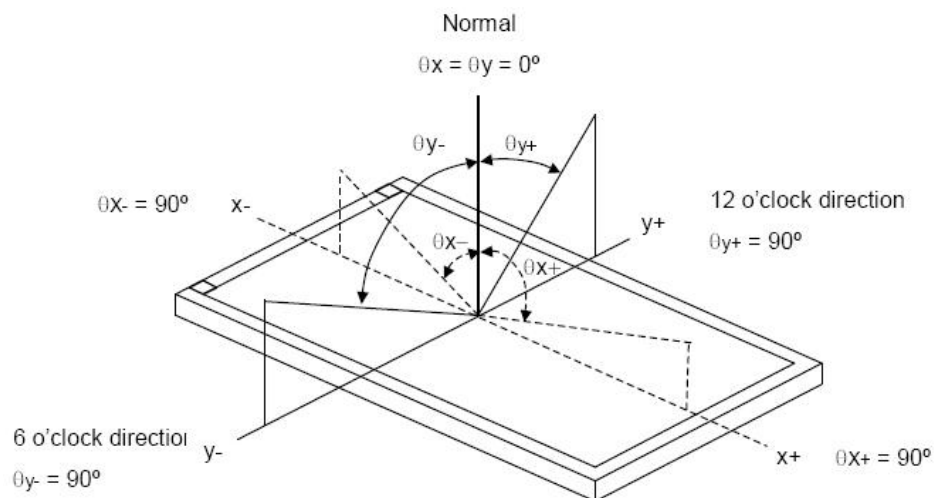
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

The measurement condition is:

|                          |                          |
|--------------------------|--------------------------|
| Measuring Equipment      | Eldim or Equivalent      |
| Measuring Point Diameter | 3mm//1mm                 |
| Measuring Point Location | Active Area centre point |
| Test pattern             | A: All Pixels white      |
|                          | B: All Pixel black       |
| Contrast setting         | Maximum                  |

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel

### 6.4. Definition of Viewing Angles



Measuring machine: LCD-5100 or EQUI

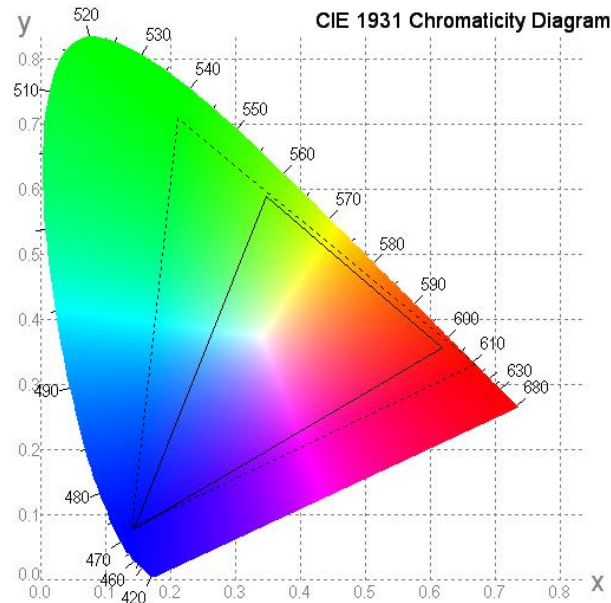
---

## 6.5. Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)



## 6.6. Definition of Surface Luminance, Uniformity and Transmittance

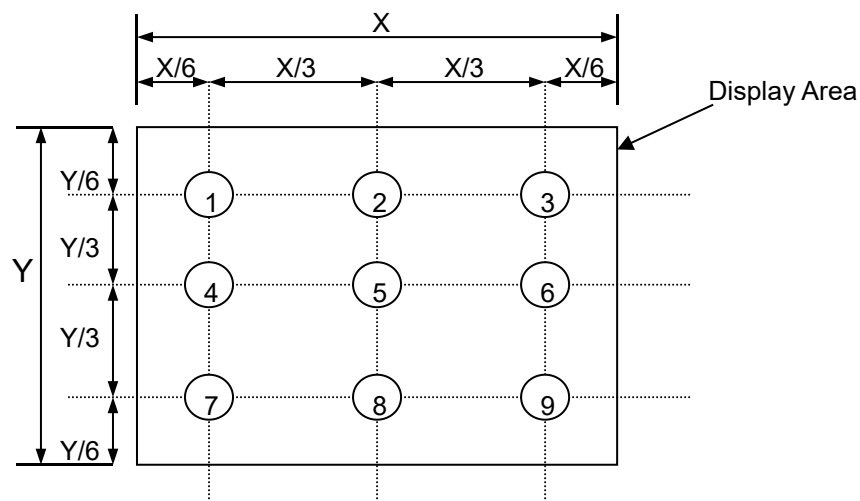
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance:  $L_V = \text{average } (L_{P1}:L_{P9})$

6.6.2. Uniformity =  $\text{Minimal } (L_{P1}:L_{P9}) / \text{Maximal } (L_{P1}:L_{P9}) * 100\%$

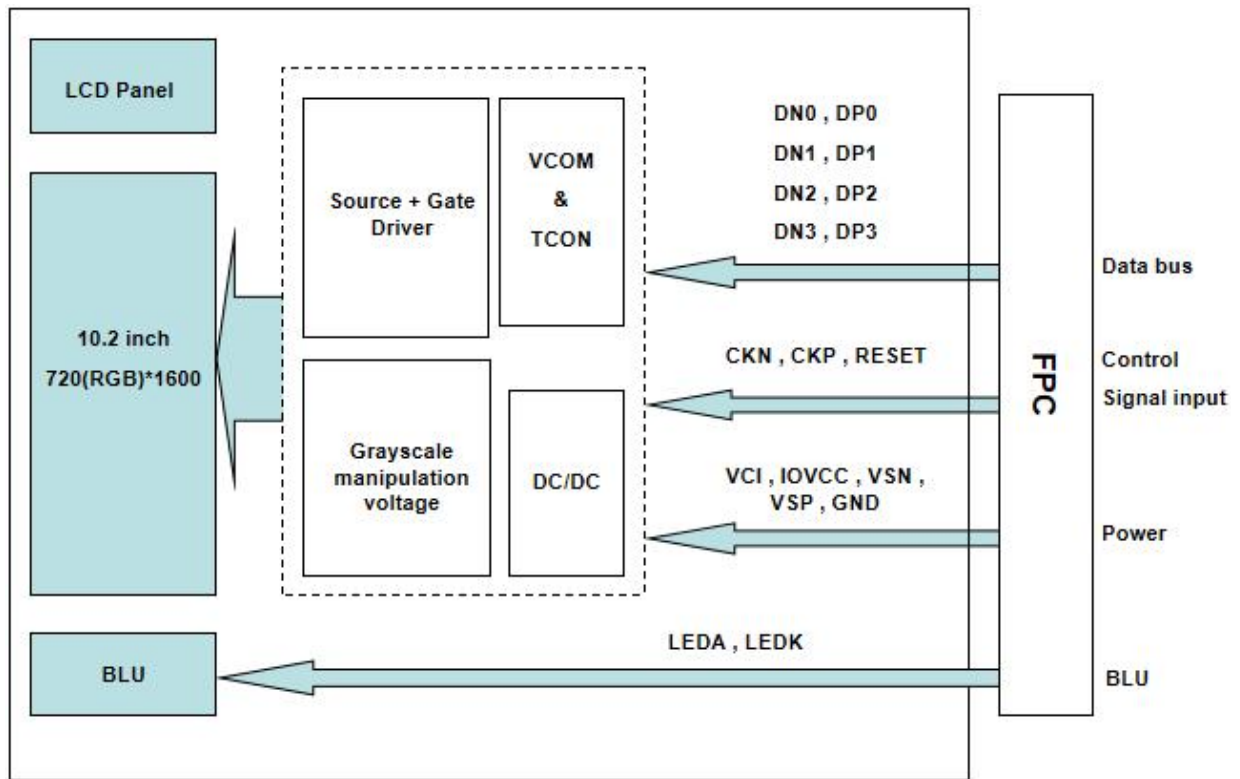
6.6.3. Transmittance =  $L_V \text{ on LCD} / L_V \text{ on Backlight} * 100\%$

Note: Measuring machine: BM-7





## 7. Block Diagram and Power Supply



---

## 8. Interface Pins Definition

| No. | Symbol | Function                            | Remark |
|-----|--------|-------------------------------------|--------|
| 1   | LEDK   | LED cathode                         |        |
| 2   | LEDK   | LED cathode                         |        |
| 3   | LEDA   | LED anode                           |        |
| 4   | LEDA   | LED anode                           |        |
| 5   | GND    | Ground                              |        |
| 6   | VCI    | Analog power supply                 |        |
| 7   | GND    | Ground                              |        |
| 8   | VSN    | Negative source driver power supply |        |
| 9   | VSP    | Positive source driver power supply |        |
| 10  | GND    | Ground                              |        |
| 11  | VCI    | Analog power supply                 |        |
| 12  | IOVCC  | Logic and interface power supply    |        |
| 13  | RESET  | Reset PIN                           |        |
| 14  | TE     | Tearing Effect pin.No connect       |        |
| 15  | GND    | Ground                              |        |
| 16  | DP3    | MIPI Positive data signal (+)       |        |
| 17  | DN3    | MIPI Negative data signal (-)       |        |
| 18  | GND    | Ground                              |        |
| 19  | DP2    | MIPI Positive data signal (+)       |        |
| 20  | DN2    | MIPI Negative data signal (-)       |        |
| 21  | GND    | Ground                              |        |
| 22  | CKP    | MIPI Positive clock signal (+)      |        |
| 23  | CKN    | MIPI Negative clock signal (-)      |        |
| 24  | GND    | Ground                              |        |
| 25  | DP1    | MIPI Positive data signal (+)       |        |
| 26  | DN1    | MIPI Negative data signal (-)       |        |
| 27  | GND    | Ground                              |        |
| 28  | DP0    | MIPI Positive data signal (+)       |        |
| 29  | DN0    | MIPI Negative data signal (-)       |        |
| 30  | GND    | Ground                              |        |

## 9. AC Characteristics

### 9.1. MIPI AC Characteristics

#### Vertical Timings for DSI video mode

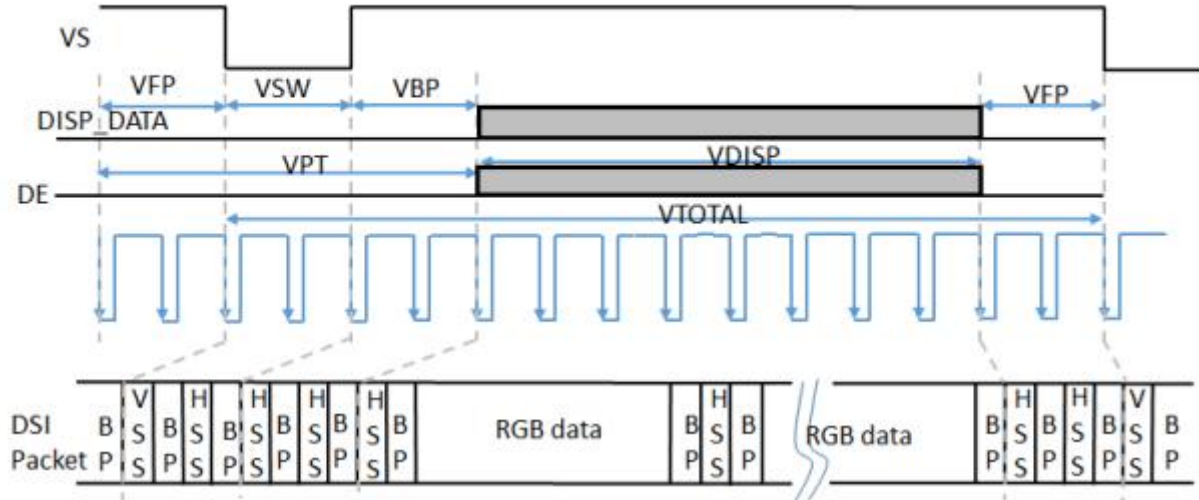


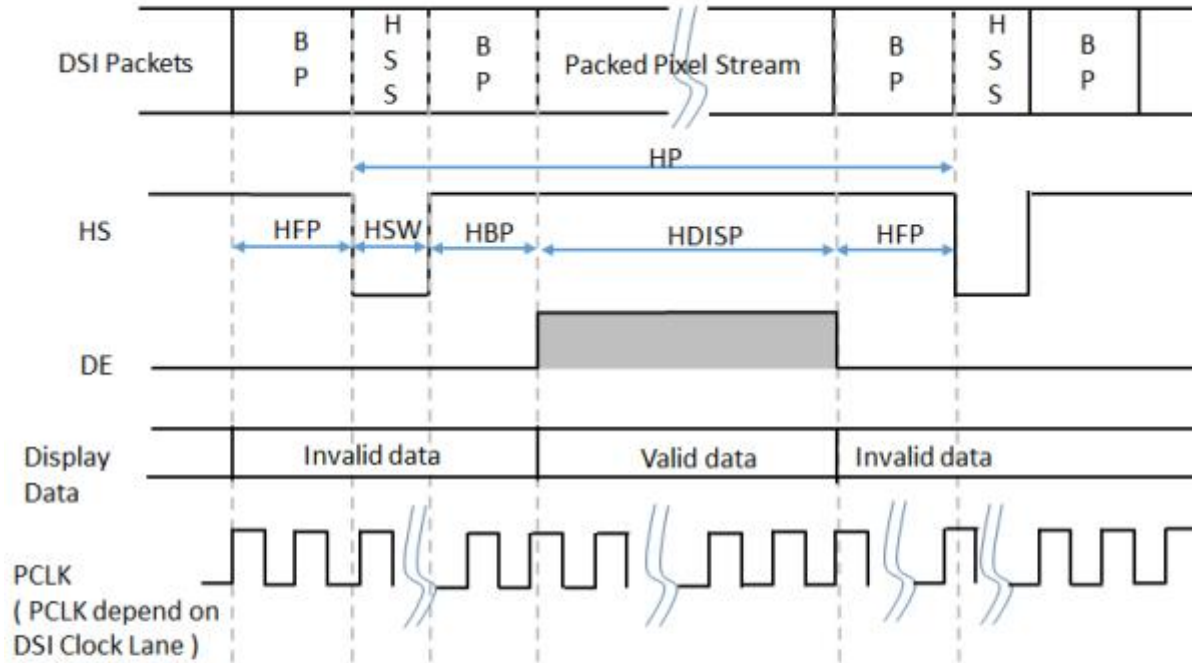
Figure - Vertical timings for DSI interface

Condition :  $T_a = 25^\circ\text{C}$ , Resolution = 720(RGB)\*1280.

| Parameter                 | Symbol      | Conditions                 | Specification |      |      | Unit | Notes |
|---------------------------|-------------|----------------------------|---------------|------|------|------|-------|
|                           |             |                            | MIN           | TYP  | MAX  |      |       |
| Vertical Total            | $V_{TOTAL}$ |                            | 1286          |      |      | Line |       |
| Vertical low pulse width  | $V_{SW}$    |                            | 2             |      |      | Line | 1     |
| Vertical front porch      | $V_{FP}$    |                            | 2             |      |      | Line |       |
| Vertical back porch       | $V_{BP}$    |                            | 2             |      |      | Line | 1     |
| Vertical data start point |             | $V_{SW} + V_{BP}$          | 4             |      |      | Line | 1     |
| Vertical blanking period  | $V_{PT}$    | $V_{SW} + V_{BP} + V_{FP}$ | 6             |      |      | Line |       |
| Vertical active area      |             | $V_{DISP}$                 | -             | 1280 | 1760 | Line |       |
| Vertical Frame rate       | $V_{FR}$    |                            |               | 60   |      | Hz   |       |

**Note 1:** The VSW and VBP pulse width are related to panel GOA timing. The GOA timing must be set at corresponding position for LCM normal display.

## Horizontal Timings for DSI video mode



**Figure - Horizontal timings for DSI video mode**

Condition : Ta =25°C ,Resolution = 720(RGB)\*1280.

| Parameter                   | Symbol | Conditions  | Specification |     |     | Unit | Notes |
|-----------------------------|--------|-------------|---------------|-----|-----|------|-------|
|                             |        |             | MIN           | TYP | MAX |      |       |
| HS low pulse width          | HSW    |             | 0.2           |     |     | uS   |       |
| Horizontal back porch       | HBP    |             | 1.0           |     |     | uS   |       |
| Horizontal front porch      | HFP    |             | 1.0           |     |     | uS   |       |
| Horizontal data start point |        | HSW+HBP     | 1.2           |     |     | uS   |       |
| Horizontal blanking period  | HBLK   | HSW+HBP+HFP | 2.2           |     |     | uS   |       |
| Horizontal active area      | HDISP  |             |               | -   | 720 | DCLK |       |

## High Speed Mode - Clock Timings

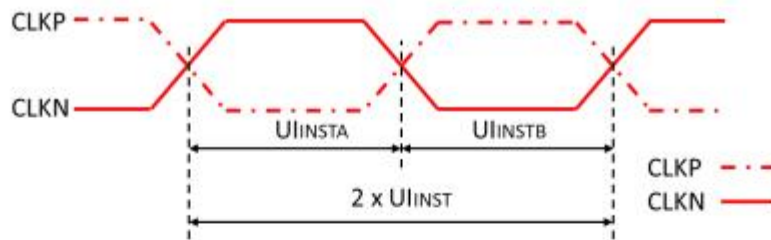


Figure - Clock Timing

| Signal  | Symbol                   | Parameter               | Specification |     |      | Unit | Notes |
|---------|--------------------------|-------------------------|---------------|-----|------|------|-------|
|         |                          |                         | MIN           | TYP | MAX  |      |       |
| CLK P/N | $2 \times UI_{INST}$     | Double UI instantaneous | 2.5           |     | 12.5 | ns   |       |
| CLK P/N | $UI_{INSTA}, UI_{INSTB}$ | UI instantaneous Half   | 1.25          |     | 6.25 | ns   | 1,2   |

**Note 1:**  $UI = UI_{INSTA} = UI_{INSTB}$ .

**Note 2:** ICNL9707 can support max 600Mbps/lane at 4 lane and max 800Mbps/lane at 3 lane application.

## High Speed Mode - Clock / Data Timings

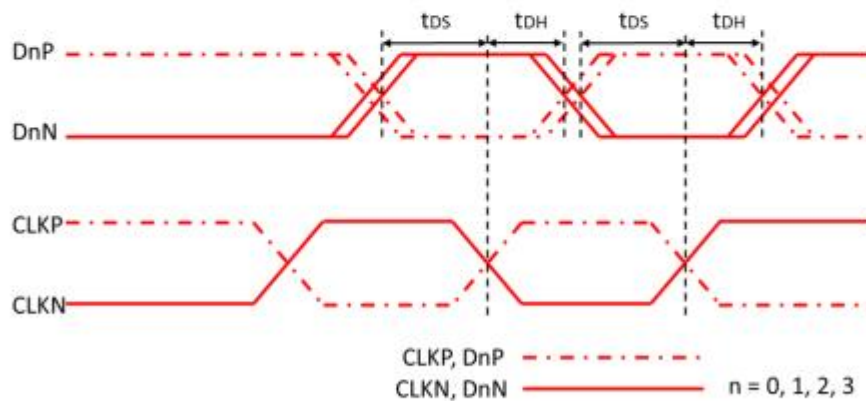


Figure - DSI Clock / Data Timings

| Signal                       | Symbol   | Parameter                | Specification    |     |     | Unit | Notes |
|------------------------------|----------|--------------------------|------------------|-----|-----|------|-------|
|                              |          |                          | MIN              | TYP | MAX |      |       |
| Dn P/N<br>( $n=0,1,2$ and 3) | $t_{DS}$ | Data to Clock Setup time | $0.15 \times UI$ |     |     | UI   |       |
|                              | $t_{DH}$ | Clock to Data Hold time  | $0.15 \times UI$ |     |     | UI   |       |

## High Speed Mode - Rising and Falling Timings

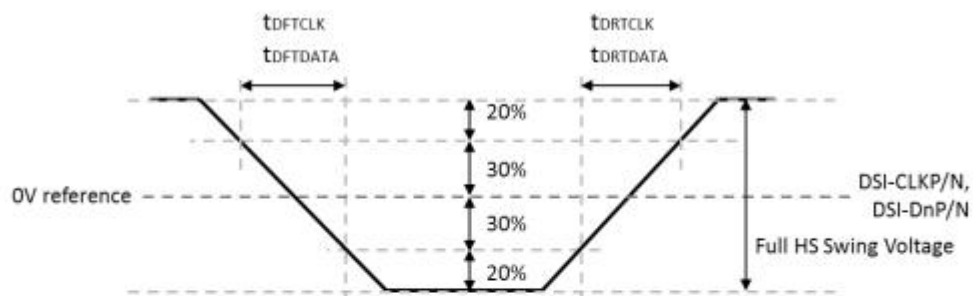


Figure - Rising and Falling Timings

| Parameter                        | Symbol        | Conditions | Specification |     |                | Unit | Notes |
|----------------------------------|---------------|------------|---------------|-----|----------------|------|-------|
|                                  |               |            | MIN           | TYP | MAX            |      |       |
| Differential Rise Time for Clock | $t_{DRTCLK}$  | CLKP/N     | 150pS         |     | $0.3 \cdot UI$ |      | 2,3   |
| Differential Rise Time for Data  | $t_{DRTDATA}$ | DnP/N      | 150pS         |     | $0.3 \cdot UI$ |      | 1,2,3 |
| Differential Fall Time for Clock | $t_{DFTCLK}$  | CLKP/N     | 150pS         |     | $0.3 \cdot UI$ |      | 2,3   |
| Differential Fall Time for Data  | $t_{DFTDATA}$ | DnP/N      | 150pS         |     | $0.3 \cdot UI$ |      | 1,2,3 |

**Note 1:** DnP/N, n =0,1,2 and 3.

**Note 2:** The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-PHY standard.

**Note 3:** DSI-CLK+ = CLKP, DSI-CLK- = CLKN, DSI-D0+ = D0P, DSI-D0- = D0N.



## Low Speed Mode - Bus Turn Around

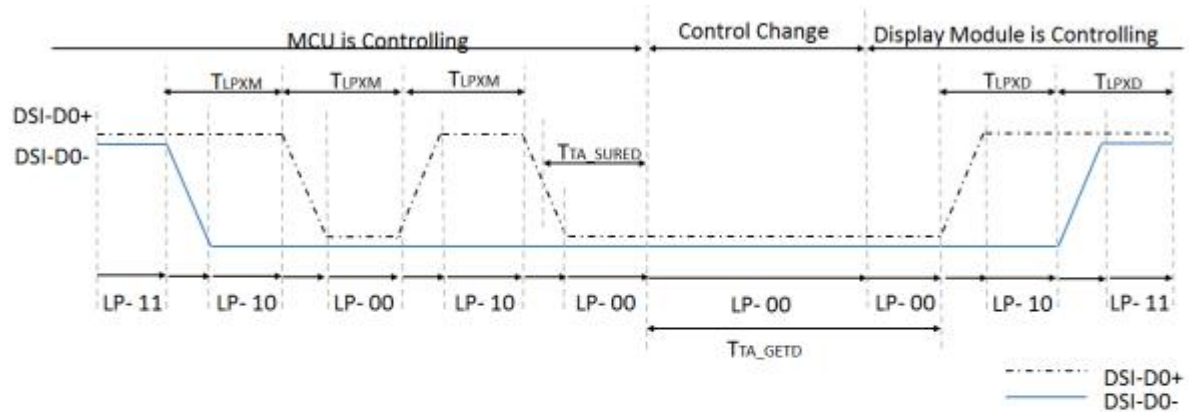


Figure - Bus Turnaround (BTA) from MCU to display module Timing

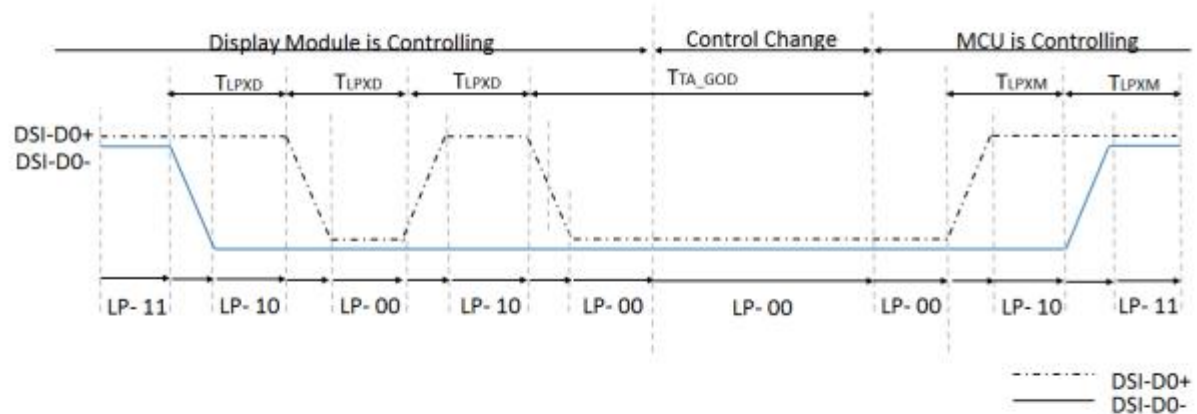
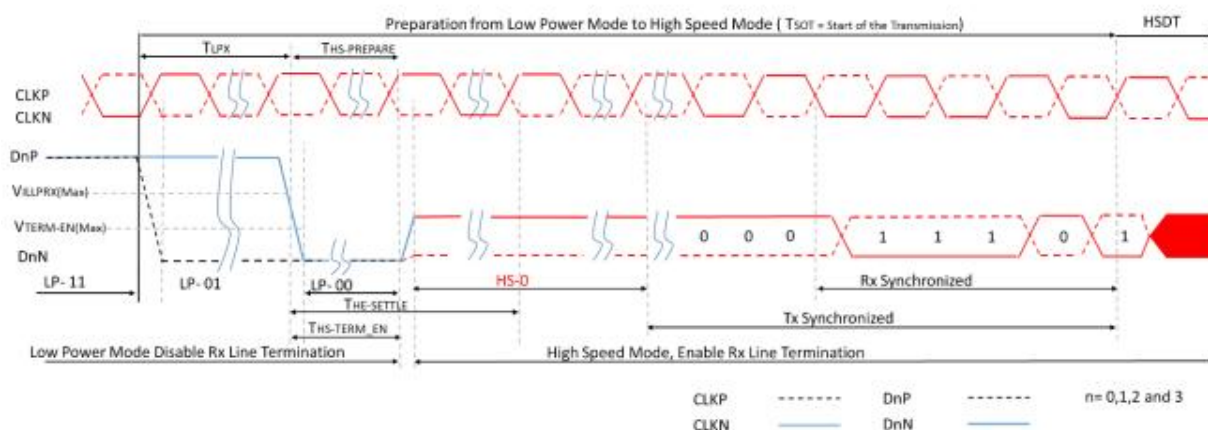


Figure - Bus Turnaround (BTA) from Display module to MCU Timing

| Signal | Symbol    | Parameter                                                         | Specification |     |          | Unit | Notes |
|--------|-----------|-------------------------------------------------------------------|---------------|-----|----------|------|-------|
|        |           |                                                                   | MIN           | TYP | MAX      |      |       |
| D0P/N  | TLPXM     | Length of LP-00,LP-01,LP-10 or LP11 periods MCU to Display Module | 50            |     | 75       | nS   | 1     |
| D0P/N  | TLPXD     | Length of LP-00,LP-01,LP-10 or LP11 periods Display Module to MCU | 50            |     | 75       | nS   | 1     |
| D0P/N  | TTA_SURED | Time-out before the Display Module starts driving                 | TLPXD         |     | 2* TLPXD | nS   | 1     |
| D0P/N  | TTA_GETD  | Time to drive LP-00 by Display Module                             | 5* TLPXD      |     |          | nS   | 1     |
| D0P/N  | TTA_GOD   | Time to drive LP-00 after turnaround request -MCU                 | 4 * TLPXD     |     |          | nS   | 1     |

**Note 1:** D0P = DSI-D0+, D0N = DSI-D0-.

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



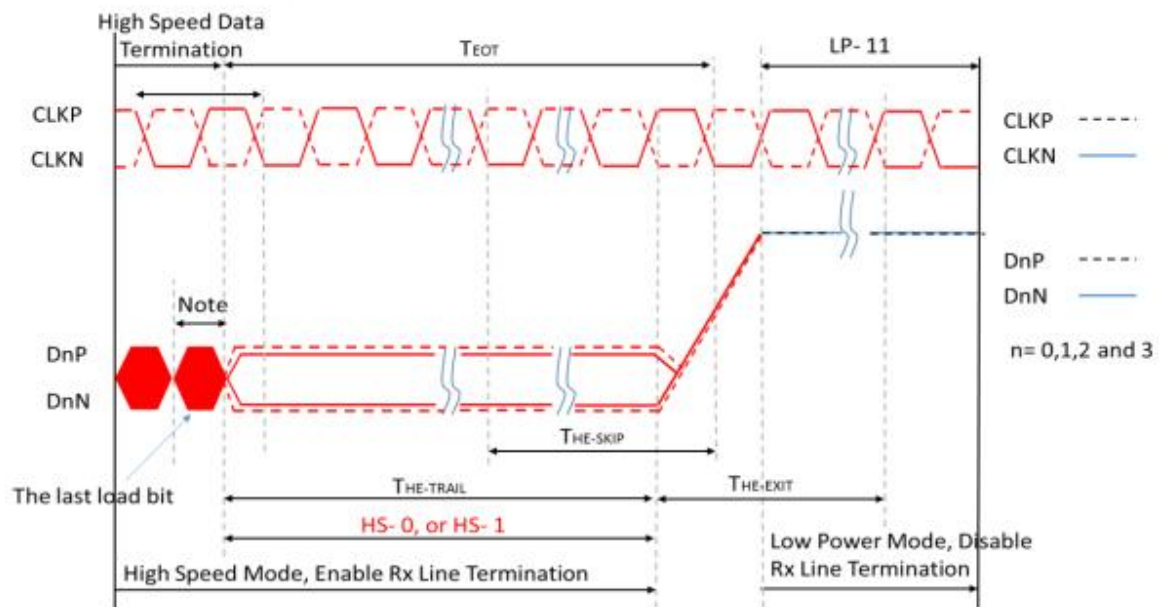
**Figure :** Data Lanes from Low Power Mode to High Speed Mode Timing

| Signal | Symbol      | Parameter                                                                               | Specification |     |         | Unit | Notes |
|--------|-------------|-----------------------------------------------------------------------------------------|---------------|-----|---------|------|-------|
|        |             |                                                                                         | MIN           | TYP | MAX     |      |       |
| DnP/N  | TLPX        | Length of any Low Power State Period                                                    | 50            |     |         | nS   | 1     |
| DnP/N  | THS-PREPARE | Time to drive LP-00 to prepare for HS Transmission                                      | 40+4*UI       |     | 85+6*UI | nS   | 1     |
| DnP/N  | THS-TERM-EN | Time to enable Data lane Receiver line termination measured from when Dn crosses VILMAX |               |     | 35+4*UI | nS   | 1     |

**Note 1:** DnP/N, n=0,1,2 and 3.



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



Note:

If the last load bit is HS- 0, the transmitter changes from HS- 0 to HS- 1.

If the last load bit is HS- 1, the transmitter changes from HS- 1 to HS- 0

**Figure - Data Lanes from High Speed Mode to Low Power Mode Timing**

| Signal | Symbol        | Parameter                                                     | Specification |     |           | Unit | Notes |
|--------|---------------|---------------------------------------------------------------|---------------|-----|-----------|------|-------|
|        |               |                                                               | MIN           | TYP | MAX       |      |       |
| DnP/N  | $T_{HS-SKIP}$ | Time-Out at Display Module to ignore transition period of EoT | 40            |     | $55+4*UI$ | nS   | 1     |
| DnP/N  | $T_{HS-EXIT}$ | Time to drive LP-11 after HS burst                            | 100           |     |           | nS   | 1     |

**Note 1:** DnP/N, n=0,1,2 and 3.

## DSI Clock Burst – High speed mode to /from Low Power Mode

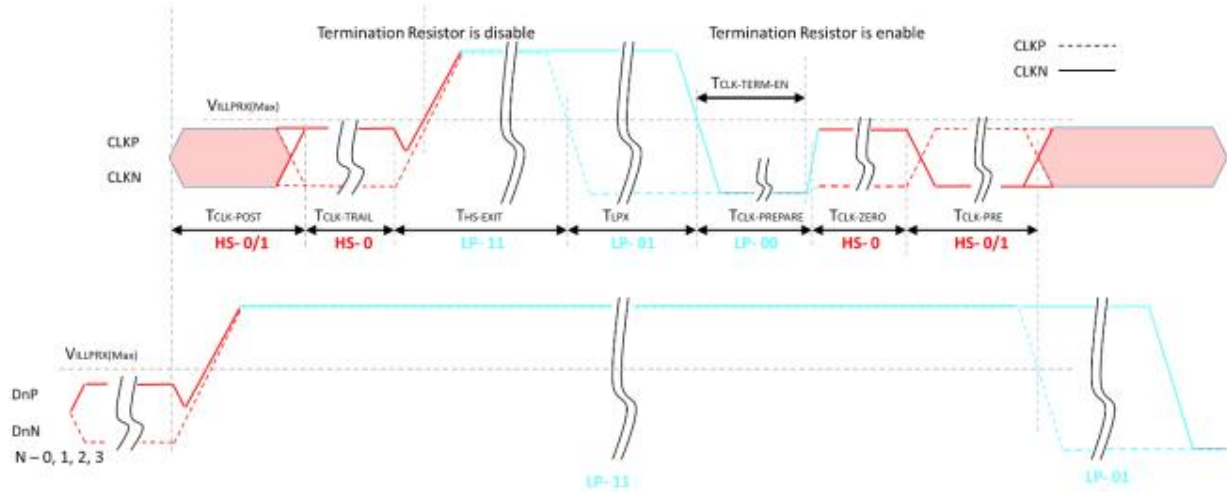


Figure - Clock Lane –High speed mode to / from Low Power Mode Timing

| Signal | Symbol                 | Parameter                                                                                                            | Specification |     |     | Unit | Notes |
|--------|------------------------|----------------------------------------------------------------------------------------------------------------------|---------------|-----|-----|------|-------|
|        |                        |                                                                                                                      | MIN           | TYP | MAX |      |       |
| CKP/N  | TCLK-POST              | Time that the MCU shall continue sending HS clock after the last associated Data Lanes has transitioned to LP mode   | 60+52*UI      |     |     | nS   |       |
| CKP/N  | TCLK-TRAIL             | Time to drive HS differential state after last payload clock bit of a HS transmission burst                          | 60            |     |     | nS   |       |
| CKP/N  | THS-EXIT               | Time to drive LP-11 after HS burst                                                                                   | 100           |     |     | nS   |       |
| CKP/N  | TCLK-PREPARE           | Time to drive LP-00 to prepare for HS transmission                                                                   | 38            |     | 95  | nS   |       |
| CKP/N  | TCLK-TERM-EN           | Time-out at Clock Lane to enable HS termination                                                                      |               |     | 38  | nS   |       |
| CKP/N  | TCLK-PREPARE+TCLK-ZERO | Minimum lead HS-0 drive period before starting Clock                                                                 | 300           |     |     | nS   |       |
| CKP/N  | TCLK-PRE               | Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode | 8*UI          |     |     | nS   |       |

## 9.2. Reset Timing

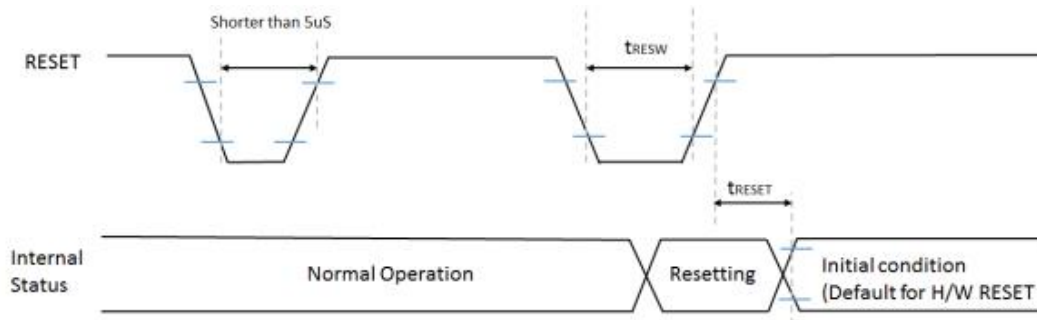


Figure - Reset Input Timing

Table - Reset Input Timing

| Signal | Symbol | Parameter             | Description                              | Specification |     |     | Unit | Notes |
|--------|--------|-----------------------|------------------------------------------|---------------|-----|-----|------|-------|
|        |        |                       |                                          | MIN           | TYP | MAX |      |       |
| RESET  | tRESW  | Reset "L" pulse width |                                          | 10            |     |     | uS   | 1     |
|        | tRESET | Reset complete time   | When reset applied during Sleep in mode  |               |     | 5   | mS   | 2     |
|        |        |                       | When reset applied during Sleep Out mode |               |     | 120 | mS   | 5     |

**Note 1:** Condition : Ta =25°C.

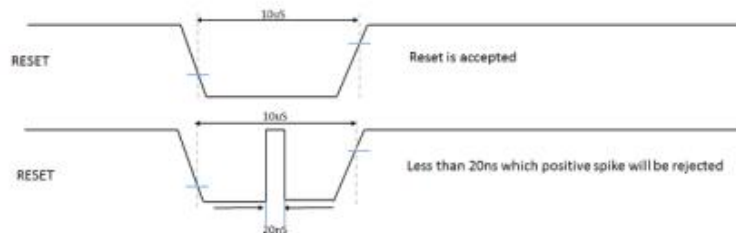
**Note 2:** Spike due to an electrostatic discharge on RESET line does not cause irregular system reset according to the table below.

| RESET Pulse          | Action         |
|----------------------|----------------|
| Less than 5us        | Reset Rejected |
| More than 10uS       | Reset          |
| Between 5us and 10uS | Reset Start    |

**Note 2:** During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in sleep out mode. The display remains the blank state in sleep in mode) and then return to Default condition for H/W RESET.

**Note3:** During Reset Complete Time, values in OTP memory will be latched to internal register during this period. This loading is done every time when there is H/W RESET complete time (tRESET) within 5ms after a rising edge of RESET.

**Note 4:** Spike Rejection also applies during a valid reset pulse as shown below:



**Note 5:** It is necessary to wait 5ms after releasing RESET when sending commands, and Sleep Out command can not be sent within 120ms.

---

## **10. Quality Assurance**

### **10.1.Purpose**

This standard for Quality Assurance assures the quality of LCD module products supplied to customer.

### **10.2.Standard for Quality Test**

#### 10.2.1. Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

#### 10.2.2. Sampling Criteria:

Visual inspection: AQL 1.5

Electrical functional: AQL 0.65.

#### 10.2.3. Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### **10.3.Nonconforming Analysis & Disposition**

#### 10.3.1. Nonconforming analysis:

10.3.1.1. Customer should provide overall information of non-conforming sample for their complaints.

10.3.1.2. After receipt of detailed information from customer, the analysis of nonconforming parts usually should be finished in one week.

10.3.1.3. If can not finish the analysis on time, customer will be notified with the progress status.

#### 10.3.2. Disposition of nonconforming:

10.3.2.1. Non-conforming product over PPM level will be replaced.

10.3.2.2. The cause of non-conformance will be analyzed. Corrective action will be discussed and implemented.

### **10.4.Agreement Items**

Shall negotiate with customer if the following situation occurs:

10.4.1. There is any discrepancy in standard of quality assurance.

10.4.2. Additional requirement to be added in product specification.

10.4.3. Any other special problem.

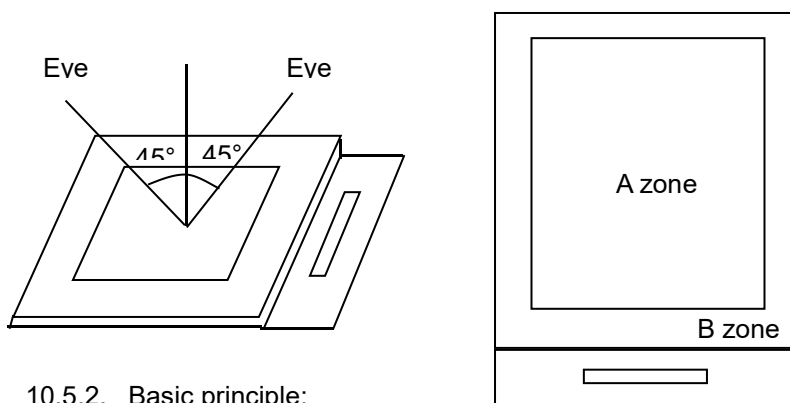
### **10.5.Standard of the Product Visual Inspection**

#### 10.5.1. Appearance inspection:

10.5.1.1. The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm.

10.5.1.2. The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

### 10.5.1.3. Definition of area: A Zone: Active Area, B Zone: Viewing Area,

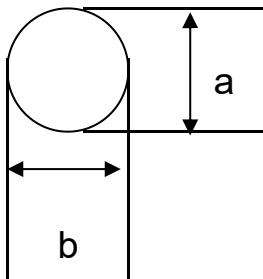


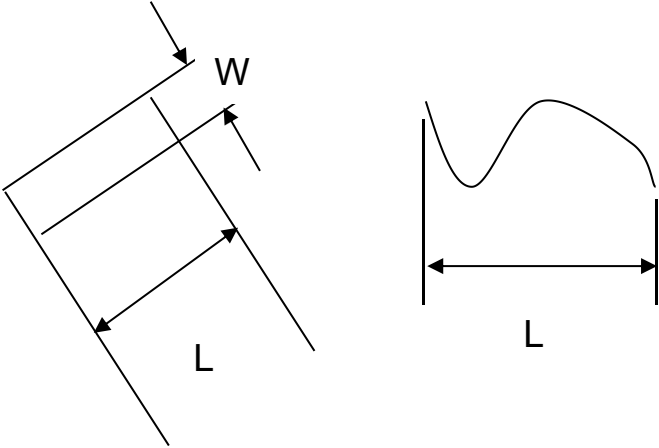
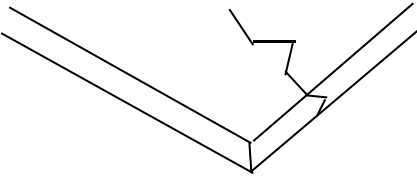
### 10.5.2. Basic principle:

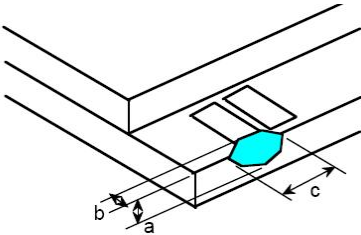
10.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

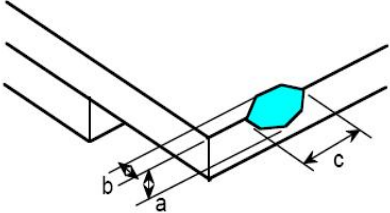
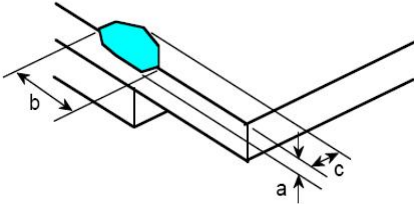
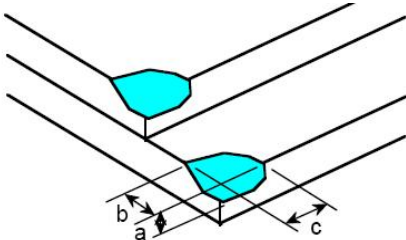
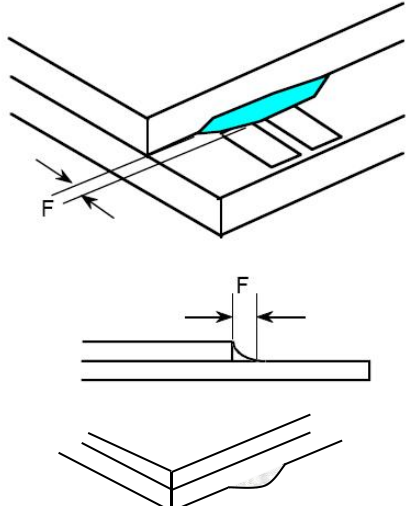
10.5.2.2. New item must be added on time when it is necessary.

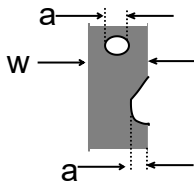
## 10.6. Inspection Specification

| No.                        | Item                                                                                                                    | Criteria (Unit: mm)                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|--------------|----------|---------------------|------------|----------------------------|---|----------------------------|------------|------------------|-----------|------------|----------------------------------|------|------------------------------------|--|-------|
| 01                         | Black / White spot<br>Foreign material<br>(Round type)<br>Pinholes<br>Stain<br>Particles inside cell.<br>(Minor defect) | <br>$\varphi = (a + b) / 2$                                                                                                                                                                                                                                                                                                         | <table><tr><th>Size \ Area</th><th>Acc. Qty</th></tr><tr><td><math>\varphi \leq 0.10</math></td><td>Ignore</td></tr><tr><td><math>0.10 &lt; \varphi \leq 0.15</math></td><td>2</td></tr><tr><td><math>0.15 &lt; \varphi \leq 0.25</math></td><td>1</td></tr><tr><td><math>0.25 &lt; \varphi</math></td><td>0</td></tr><tr><td>Total</td><td>2 no include <math>\varphi \leq 0.10</math></td></tr></table> |          |       | Size \ Area  | Acc. Qty | $\varphi \leq 0.10$ | Ignore     | $0.10 < \varphi \leq 0.15$ | 2 | $0.15 < \varphi \leq 0.25$ | 1          | $0.25 < \varphi$ | 0         | Total      | 2 no include $\varphi \leq 0.10$ |      |                                    |  |       |
|                            |                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                        | Size \ Area                                                                                                                                                                                                                                                                                                                                                                                               | Acc. Qty |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| $\varphi \leq 0.10$        | Ignore                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| $0.10 < \varphi \leq 0.15$ | 2                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| $0.15 < \varphi \leq 0.25$ | 1                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| $0.25 < \varphi$           | 0                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| Total                      | 2 no include $\varphi \leq 0.10$                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
|                            |                                                                                                                         | Distance between 2 defects should more than 3mm apart.                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| 02                         | Electrical Defect<br>(Minor defect)                                                                                     | <table><tr><td></td><td>Display Area</td><td>Total</td><td rowspan="4">Note1</td></tr><tr><td>Bright dot</td><td>0</td><td>0</td></tr><tr><td>Dark dot</td><td><math>N \leq 2</math></td><td><math>N \leq 2</math></td></tr><tr><td>Total dot</td><td><math>N \leq 2</math></td><td><math>N \leq 2</math></td></tr><tr><td>Mura</td><td colspan="2">Not visible through 5% ND filters.</td><td>Note2</td></tr></table> |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       | Display Area | Total    | Note1               | Bright dot | 0                          | 0 | Dark dot                   | $N \leq 2$ | $N \leq 2$       | Total dot | $N \leq 2$ | $N \leq 2$                       | Mura | Not visible through 5% ND filters. |  | Note2 |
|                            |                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                        | Display Area                                                                                                                                                                                                                                                                                                                                                                                              | Total    | Note1 |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| Bright dot                 | 0                                                                                                                       | 0                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| Dark dot                   | $N \leq 2$                                                                                                              | $N \leq 2$                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| Total dot                  | $N \leq 2$                                                                                                              | $N \leq 2$                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
| Mura                       | Not visible through 5% ND filters.                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                        | Note2                                                                                                                                                                                                                                                                                                                                                                                                     |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |
|                            |                                                                                                                         | Remark:<br>1. Bright dot caused by scratch and foreign object accords to item 1.                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                           |          |       |              |          |                     |            |                            |   |                            |            |                  |           |            |                                  |      |                                    |  |       |

| 03           | Black and White line Scratch<br>Foreign material<br>(Line type)<br>(Minor defect) |  <table border="1"> <thead> <tr> <th>Length</th><th>Width</th><th>Acc. Qty</th></tr> </thead> <tbody> <tr> <td>/</td><td><math>W \leq 0.03</math></td><td>Ignore</td></tr> <tr> <td><math>L \leq 2.5</math></td><td><math>0.03 &lt; W \leq 0.05</math></td><td>3</td></tr> <tr> <td><math>L \leq 2.5</math></td><td><math>0.05 &lt; W \leq 0.10</math></td><td>2</td></tr> <tr> <td>/</td><td><math>0.1 &lt; W</math></td><td></td></tr> <tr> <td colspan="2">Total</td><td>3</td></tr> </tbody> </table> <p>Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.</p> | Length | Width | Acc. Qty | / | $W \leq 0.03$ | Ignore | $L \leq 2.5$ | $0.03 < W \leq 0.05$ | 3 | $L \leq 2.5$ | $0.05 < W \leq 0.10$ | 2 | / | $0.1 < W$ |  | Total |  | 3 |
|--------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----------|---|---------------|--------|--------------|----------------------|---|--------------|----------------------|---|---|-----------|--|-------|--|---|
| Length       | Width                                                                             | Acc. Qty                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |
| /            | $W \leq 0.03$                                                                     | Ignore                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |
| $L \leq 2.5$ | $0.03 < W \leq 0.05$                                                              | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |
| $L \leq 2.5$ | $0.05 < W \leq 0.10$                                                              | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |
| /            | $0.1 < W$                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |
| Total        |                                                                                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |
| 04           | Glass Crack<br>(Minor defect)                                                     |  <p>Crack is potential to enlarge, any type is not allowed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |       |          |   |               |        |              |                      |   |              |                      |   |   |           |  |       |  |   |

| 05                           | <p>Glass Chipping Pad Area:<br/>(Minor defect)</p>  | <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td><math>c &gt; 3.0, b &lt; 1.0</math></td><td>1</td></tr><tr><td><math>c &lt; 3.0, b &lt; 1.0</math></td><td>3</td></tr><tr><td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td></tr></table>                                                                | Length and Width | Acc. Qty | $c > 3.0, b < 1.0$ | 1 | $c < 3.0, b < 1.0$ | 3 | $a < \text{Glass Thickness}$ |   |                              |  |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|--------------------|---|--------------------|---|------------------------------|---|------------------------------|--|
| Length and Width             | Acc. Qty                                                                                                                               |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $c > 3.0, b < 1.0$           | 1                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $c < 3.0, b < 1.0$           | 3                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $a < \text{Glass Thickness}$ |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| 06                           | <p>Glass Chipping Rear of Pad Area:<br/>(Minor defect)</p>                                                                             | <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td><math>c &gt; 3.0, b &lt; 1.0</math></td><td>1</td></tr><tr><td><math>c &lt; 3.0, b &lt; 1.0</math></td><td>2</td></tr><tr><td><math>c &lt; 3.0, b &lt; 0.5</math></td><td>4</td></tr><tr><td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td></tr></table> | Length and Width | Acc. Qty | $c > 3.0, b < 1.0$ | 1 | $c < 3.0, b < 1.0$ | 2 | $c < 3.0, b < 0.5$           | 4 | $a < \text{Glass Thickness}$ |  |
| Length and Width             | Acc. Qty                                                                                                                               |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $c > 3.0, b < 1.0$           | 1                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $c < 3.0, b < 1.0$           | 2                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $c < 3.0, b < 0.5$           | 4                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |
| $a < \text{Glass Thickness}$ |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |   |                    |   |                              |   |                              |  |

|                              |                                                            |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|--------------------|--------|------------------------------|---|--------------------|---|------------------------------|--|
| 07                           | <p>Glass Chipping Except Pad Area:<br/>(Minor defect)</p>  | <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td><math>c &gt; 3.0, b &lt; 1.0</math></td><td>1</td></tr><tr><td><math>c &lt; 3.0, b &lt; 1.0</math></td><td>2</td></tr><tr><td><math>c &lt; 3.0, b &lt; 0.5</math></td><td>4</td></tr><tr><td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td></tr></table> | Length and Width | Acc. Qty | $c > 3.0, b < 1.0$ | 1      | $c < 3.0, b < 1.0$           | 2 | $c < 3.0, b < 0.5$ | 4 | $a < \text{Glass Thickness}$ |  |
| Length and Width             | Acc. Qty                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $c > 3.0, b < 1.0$           | 1                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $c < 3.0, b < 1.0$           | 2                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $c < 3.0, b < 0.5$           | 4                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $a < \text{Glass Thickness}$ |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| 08                           | <p>Glass Corner Chipping:<br/>(Minor defect)</p>          | <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td><math>c &lt; 3.0, b &lt; 3.0</math></td><td>Ignore</td></tr><tr><td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td></tr></table>                                                                                                                          | Length and Width | Acc. Qty | $c < 3.0, b < 3.0$ | Ignore | $a < \text{Glass Thickness}$ |   |                    |   |                              |  |
| Length and Width             | Acc. Qty                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $c < 3.0, b < 3.0$           | Ignore                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $a < \text{Glass Thickness}$ |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| 09                           | <p>Glass Burr:<br/>(Minor defect)</p>                    | <table><tr><th>Length</th><th>Acc. Qty</th></tr><tr><td><math>F &lt; 1.0</math></td><td>Ignore</td></tr></table> <p>Glass burr don't affect assemble and module dimension.</p>                                                                                                                                                          | Length           | Acc. Qty | $F < 1.0$          | Ignore |                              |   |                    |   |                              |  |
| Length                       | Acc. Qty                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |
| $F < 1.0$                    | Ignore                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                         |                  |          |                    |        |                              |   |                    |   |                              |  |

| 10                         | FPC Defect:<br>(Minor defect)<br> | 10.1 Dent, pinhole width $a < w/3$ .<br>(w: circuitry width.)<br>10.2 Open circuit is unacceptable.<br>10.3 No oxidation, contamination and distortion.                                                                                                                                                                        |          |          |                     |        |                            |   |                            |   |                  |      |
|----------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|---------------------|--------|----------------------------|---|----------------------------|---|------------------|------|
| 11                         | Bubble on Polarizer<br>(Minor defect)                                                                              | <table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td><math>\varphi \leq 0.20</math></td><td>Ignore</td></tr><tr><td><math>0.20 &lt; \varphi \leq 0.30</math></td><td>4</td></tr><tr><td><math>0.30 &lt; \varphi \leq 0.50</math></td><td>1</td></tr><tr><td><math>0.50 &lt; \varphi</math></td><td>None</td></tr></table> | Diameter | Acc. Qty | $\varphi \leq 0.20$ | Ignore | $0.20 < \varphi \leq 0.30$ | 4 | $0.30 < \varphi \leq 0.50$ | 1 | $0.50 < \varphi$ | None |
| Diameter                   | Acc. Qty                                                                                                           |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $\varphi \leq 0.20$        | Ignore                                                                                                             |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $0.20 < \varphi \leq 0.30$ | 4                                                                                                                  |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $0.30 < \varphi \leq 0.50$ | 1                                                                                                                  |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $0.50 < \varphi$           | None                                                                                                               |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| 12                         | Dent on Polarizer<br>(Minor defect)                                                                                | <table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td><math>\varphi \leq 0.20</math></td><td>Ignore</td></tr><tr><td><math>0.20 &lt; \varphi \leq 0.30</math></td><td>4</td></tr><tr><td><math>0.30 &lt; \varphi \leq 0.50</math></td><td>1</td></tr><tr><td><math>0.50 &lt; \varphi</math></td><td>None</td></tr></table> | Diameter | Acc. Qty | $\varphi \leq 0.20$ | Ignore | $0.20 < \varphi \leq 0.30$ | 4 | $0.30 < \varphi \leq 0.50$ | 1 | $0.50 < \varphi$ | None |
| Diameter                   | Acc. Qty                                                                                                           |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $\varphi \leq 0.20$        | Ignore                                                                                                             |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $0.20 < \varphi \leq 0.30$ | 4                                                                                                                  |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $0.30 < \varphi \leq 0.50$ | 1                                                                                                                  |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| $0.50 < \varphi$           | None                                                                                                               |                                                                                                                                                                                                                                                                                                                                |          |          |                     |        |                            |   |                            |   |                  |      |
| 13                         | Bezel                                                                                                              | 13.1 No rust, distortion on the Bezel.<br>13.2 No visible fingerprints, stains or other contamination.                                                                                                                                                                                                                         |          |          |                     |        |                            |   |                            |   |                  |      |
| 14                         | PCB                                                                                                                | 14.1 No distortion or contamination on PCB terminals.<br>14.2 All components on PCB must same as documented on the BOM/component layout.<br>14.3 Follow IPC-A-600F.                                                                                                                                                            |          |          |                     |        |                            |   |                            |   |                  |      |
| 15                         | Soldering                                                                                                          | Follow IPC-A-610C standard                                                                                                                                                                                                                                                                                                     |          |          |                     |        |                            |   |                            |   |                  |      |
| 16                         | Electrical Defect<br>(Major defect)                                                                                | The below defects must be rejected.<br>16.1 Missing vertical / horizontal segment,<br>16.2 Abnormal Display.<br>16.3 No function or no display.<br>16.4 Current exceeds product specifications.<br>16.5 LCD viewing angle defect.<br>16.6 No Backlight.<br>16.7 Dark Backlight.<br>16.8 Touch Panel no function.               |          |          |                     |        |                            |   |                            |   |                  |      |

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.



---

## 10.7. Classification of Defects

10.7.1. Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

10.7.2. Two minor defects are equal to one major in lot sampling inspection.

## 10.8. Identification/marketing criteria

Any unit with illegible / wrong / double or no marking/ label shall be rejected.

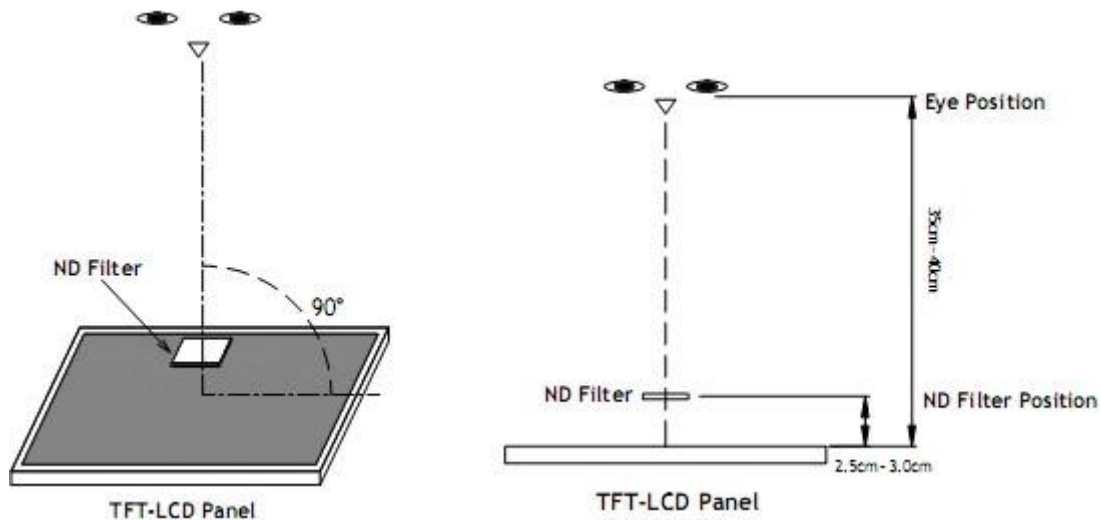
## 10.9. Packaging

10.9.1. There should be no damage of the outside carton box, each packaging box should have one identical label.

10.9.2. Modules inside package box should have compliant mark.

10.9.3. All direct package materials shall offer ESD protection.

**Note1:** Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixel area.



**Bright dot:** The bright dot size defect at black display pattern. It can be recognized by 2% transparency of filter when the distance between eyes and panel is  $350\text{mm} \pm 50\text{mm}$ .

**Dark dot:** Cyan, Magenta or Yellow dot size defect at white display pattern. It can be recognized by 5% transparency of filter when the distance between eyes and panel is  $350\text{mm} \pm 50\text{mm}$ .

**Note2:** Mura on display which appears darker / brighter against background brightness on parts of display area.

---

## 11. Reliability Specification

| No | Item                        | Condition                                                                                   | Quantity | Criteria         |
|----|-----------------------------|---------------------------------------------------------------------------------------------|----------|------------------|
| 1  | High Temperature Operating  | <b>70℃, 96Hrs</b>                                                                           | 2        | GB/T2423.2-2008  |
| 2  | Low Temperature Operating   | <b>-20℃,96Hrs</b>                                                                           | 2        | GB/T2423.1-2008  |
| 3  | High Humidity               | <b>50℃, 90%RH, 96Hrs</b>                                                                    | 2        | GB/T2423.3-2016  |
| 4  | High Temperature Storage    | <b>80℃, 96Hrs</b>                                                                           | 2        | GB/T2423.2-2008  |
| 5  | Low Temperature Storage     | <b>-30℃, 96Hrs</b>                                                                          | 2        | GB/T2423.1-2008  |
| 6  | Thermal Cycling Test        | <b>-20℃, 60min~70℃, 60min, 20 cycles.</b>                                                   | 2        | GB/T2423.22-2012 |
| 7  | Packing vibration           | Frequency range:10Hz~50Hz<br>Acceleration of gravity:5G<br>X,Y,Z 30 min for each direction. | -        | GB/T5170.14-2009 |
| 8  | Electrical Static Discharge | Air:±4KV 150pF/330Ω 5 times<br>Contact:±2KV 150pF/330Ω 5 times                              | 2        | GB/T17626.2-2018 |
| 9  | Drop Test (Packaged)        | Height:80 cm,1 corner, 3 edges, 6 surfaces.                                                 | -        | GB/T2423.8-1995  |

Note1. No defection cosmetic and operational function allowable.

Note2. Total current Consumption should be below double of initial value

---

## 12. Precautions and Warranty

### 12.1. Safety

- 12.1.1. The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.
- 12.1.2. Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

### 12.2. Handling

- 12.2.1. Reverse and use within ratings in order to keep performance and prevent damage.
- 12.2.2. Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

### 12.3. Storage

- 12.3.1. Do not store the LCD module beyond the specified temperature ranges.
- 12.3.2. Strong light exposure causes degradation of polarizer and color filter.

### 12.4. Metal Pin (Apply to Products with Metal Pins)

#### 12.4.1. Pins of LCD and Backlight

- 12.4.1.1. Solder tip can touch and press on the tip of Pin LEAD during the soldering

#### 12.4.1.2. Recommended Soldering Conditions

Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1

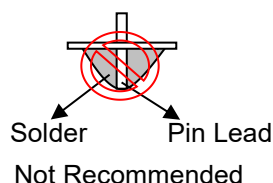
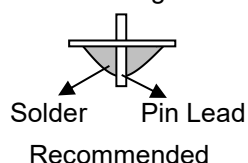
Maximum Solder Temperature: 370°C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20°C

Typical Soldering Time: ≤3s

#### 12.4.1.3. Solder Wetting



#### 12.4.2. Pins of EL

- 12.4.2.1. Solder tip can touch and press on the tip of EL leads during soldering.

- 12.4.2.2. No Solder Paste on the soldering pad on the motherboard is recommended.

#### 12.4.2.3. Recommended Soldering Conditions

Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm

Recommended Solder Temperature: 270~290°C

Typical Soldering Time: ≤2s

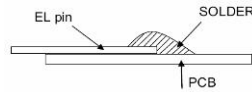
Minimum solder distance from EL lamp (body): 2.0mm

- 12.4.2.4. No horizontal press on the EL leads during soldering.

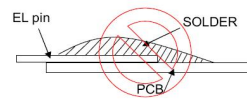
- 12.4.2.5. 180° bend EL leads three times is not allowed.
-

---

#### 12.4.2.6. Solder Wetting

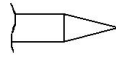


Recommended

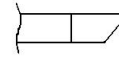


Not Recommended

#### 12.4.2.7. The type of the solder iron:

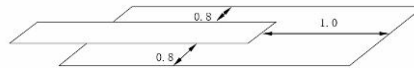


Recommended



Not Recommended

#### 12.4.2.8. Solder Pad



### 12.5. Operation

- 12.5.1. Do not drive LCD with DC voltage
- 12.5.2. Response time will increase below lower temperature
- 12.5.3. Display may change color with different temperature
- 12.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear “fractured”.
- 12.5.5. Do not connect or disconnect the LCM to or from the system when power is on.
- 12.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.
- 12.5.7. Module has high frequency circuits. Sufficient suppression to the electromagnetic interface shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- 12.5.8. Do not display the fixed pattern for long time (we suggest the time not longer than one hour) because it will develop image sticking due to the TFT structure.

### 12.6. Static Electricity

- 12.6.1. CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.
- 12.6.2. The normal static prevention measures should be observed for work clothes and benches.
- 12.6.3. The module should be kept into anti-static bags or other containers resistant to static for storage.

### 12.7. Limited Warranty

- 12.7.1. Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 12.7.2. If possible, we suggest customer to use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used.
- 12.7.3. After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

---

### 13. Packaging

TBD

## 14. Outline Drawing

