

|                      |  |
|----------------------|--|
| Project No.<br>项目编号  | 2.86inch 376x960   |
| Customer<br>客户名称     |  |
| Module No.<br>客户型号   |  |
| Product type<br>产品内容 | Standard LCD Module<br>376 x 3RGB x 960 Dots<br>2.9" IPS TFT LCD |

Signature by customer:  
客户确认签章:

|     |      |      |      |     |
|-----|------|------|------|-----|
| 编 制 | 电子审核 | 结构审核 | 品质审核 | 批 准 |
|     |      |      |      |     |

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**1. Document revision history:**

| DOCUMENT REVISION | DATE       | DESCRIPTION    | PREPARED BY | APPROVED BY |
|-------------------|------------|----------------|-------------|-------------|
| A                 | 2021.01.07 | First Release. | HJ          |             |

## 2. General Description

- 2.9”(diagonal), 376 x3 RGB x 960dots, 16.7Mcolors, TFT LCD module.
- Viewing Direction: all
- Driving IC: ST7701S
- mipi 1 lane interface.
- Logic voltage: 1.8/2.8V (typ.).
- With touch panel

## 3. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

| Parameter                                  | Specifications            | Unit                      |      |
|--|---------------------------|---------------------------|------|
| Outline dimensions                         | 31.2 (W) x76.6(H)x 2.4(D) | mm                        |      |
| without Touch Panel &Color TFT 480xRGBx854 |                           | mm                        |      |
|  |                           | mm                        |      |
|  | LCD active area           | 26.51(W) x67.68(H)        | mm   |
|  | Display format            | 376x3 RGB x 960           | dots |
|  | Color configuration       | RGB stripes               | -    |
|  | Dot pitch                 | 0.0705RGB)(W) x 0.0705(H) | mm   |
| Weight                                     | TBD                       | grams                     |      |

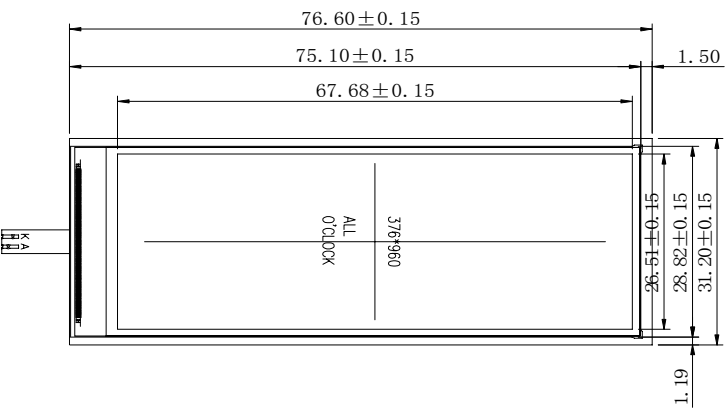
**Figure 1: Outline Drawing**

注：标注 \* 请重点确认

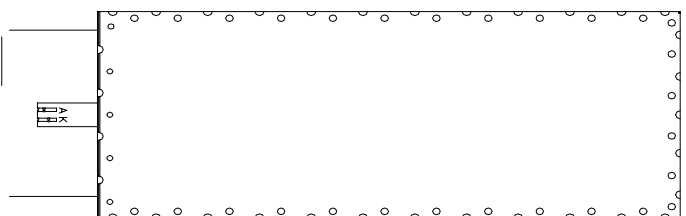
RoHS

接口定义：

|       |
|-------|
| N     |
| DON   |
| DOP   |
| GND   |
| CLKN  |
| CLKP  |
| GND   |
| VCC   |
| IOVCC |
| RESET |
| GND   |
| LEDK  |
| LEDA  |

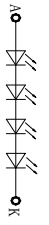


51.0±0.15



0.010±0.0015

|                       |                     |
|-----------------------|---------------------|
| Display Type          | type                |
| Main driver IC        | 376*(RGB)*960       |
| Resolution            |                     |
| Viewing Angle         |                     |
| Gray Scale            | Inversion Direction |
| Operation Temperature | Operating Voltage   |
| Storage Temperature   | Interface           |
|                       | MMP                 |



...A

|                         |                 |                             |
|-------------------------|-----------------|-----------------------------|
| UNIT: mm                | SCALE: NO SCALE | SIZE: A4                    |
| GENERAL TOLERANCE: ±0.2 | Angle=1°        |                             |
| DESIGNED: _____         | Date            | PART NAME: MODULE DRAWING   |
| CHECKED: _____          | Date            | DRAWING NO.: MS-LZ29001BS-A |
| APPROVED: _____         | Date            | PROJECT NO.: LZ29001BS      |
|                         |                 | SHEET: 1/1                  |
|                         |                 | REV: A                      |



## 5. Absolute Maximum Ratings

### 5.1 Electrical Maximum Ratings – for IC Only

Table 4: Electrical Maximum Ratings – for IC

| Parameter                    | Symbol | Min. | Max. | Unit | Note |
|------------------------------|--------|------|------|------|------|
| Power supply voltage (VCC)   | VCC    | -0.3 | +3.6 | V    | 1    |
| Power supply voltage (IOVCC) | IOVCC  | -0.3 | +3.6 | V    | 1    |

Note:

1. VCC, GND must be maintained.
2. The modules may be destroyed if they are used beyond the absolute maximum ratings.

### 5.2 Environmental Condition

Table 5

| Item                | Operating temperature (Topr)  |       | Storage temperature (TSgt) (Note 1) |       | Remark          |
|---------------------|---|-------|-------------------------------------|-------|-----------------|
|                     | Min.  | Max.  | Min.                                | Max.  |                 |
| Ambient temperature | -20°C   | +70°C | -30°C                               | +80°C | Dry             |
| Humidity (Note 1)   | 80% max. RH for $T_a \leq 40^\circ\text{C}$<br>< 50% RH for $40^\circ\text{C} < T_a \leq$ Maximum operating temperature |       |                                     |       | No condensation |

Note 1: Product cannot sustain at extreme storage conditions for long time.

## 6. Electrical Specifications

### Typical Electrical Characteristics

At  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = IOVCC = 2.6\text{V}$  to  $3.3\text{V}$ ,  $GND = 0\text{V}$ .

Table 6

| Parameter                             | Symbol                     | Conditions               | Min. | Typ. | Max. | Unit              |
|---------------------------------------|----------------------------|--------------------------|------|------|------|-------------------|
| Supply voltage (logic)                | VCC-GND                    |                          | 2.6  | 2.8  | 3.3  | V                 |
| Supply voltage (logic)                | IOVCC-GND                  |                          |      | 1.8  |      | V                 |
| Supply current (Logic & LCD)          | ICC                        | VCC=1.8V                 | -    | -    | 20   | mA                |
| Supply voltage of white LED backlight | VLED<br>=V(BL+)-<br>V(BL-) | Forward current<br>=20mA | -    | 12.8 | -    | V                 |
| Luminance (on the module surface)     |                            | Number of LED dies = 4   | -    | 300  | -    | cd/m <sup>2</sup> |

## 7. Optical Characteristics

Table 7: Optical specifications

| Items          | Symbol         | Condition      | Specifications |       |       | Unit |
|----------------|----------------|----------------|----------------|-------|-------|------|
|                |                |                | Min.           | Typ.  | Max.  |      |
| Contrast Ratio | CR             |                | -              | 900   | -     | -    |
| Response Time  | T <sub>R</sub> |                | -              |       |       | ms   |
|                | T <sub>F</sub> |                | -              |       |       | ms   |
| Chromaticity   | Red            | X <sub>R</sub> | 0.589          | 0.619 | 0.649 | -    |
|                |                | Y <sub>R</sub> | 0.302          | 0.332 | 0.362 | -    |
|                | Green          | X <sub>G</sub> | 0.273          | 0.303 | 0.333 | -    |
|                |                | Y <sub>G</sub> | 0.533          | 0.563 | 0.593 | -    |
|                | Blue           | X <sub>B</sub> | 0.105          | 0.135 | 0.165 | -    |
|                |                | Y <sub>B</sub> | 0.104          | 0.134 | 0.164 | -    |
|                | White          | X <sub>W</sub> | 0.288          | 0.318 | 0.348 | -    |
|                |                | Y <sub>W</sub> | 0.310          | 0.340 | 0.370 | -    |
| Viewing angle  | Hor.           | φ1(3 o'clock)  | 75             | 85    | -     | deg. |
|                |                | φ2(9 o'clock)  | 75             | 85    | -     |      |
|                | Ver.           | θ2(12 o'clock) | 75             | 85    | -     |      |
|                |                | θ1(6 o'clock)  | 75             | 85    | -     |      |
| NTSC ratio     |                |                |                | 70    |       | %    |

Note

Note 1:

1. Contrast Ratio(CR) is defined mathematically as :

Surface Luminance with all white pixels

Contrast Ratio = -----

Surface Luminance with all black pixels

- Surface luminance is the center point across the TFT-LCD surface 240 mm from the surface with all pixels displaying white.
- Response time is the time required for the display to transition from black to white(Rise Time, Tr) and from white to black(Falling Time, Tf).
- Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the TFT-LCD surface.
- Optimum contrast is obtained by adjusting the TFT-LCD Threshold voltage(Vth & Vsat)

Note 2: Definition of Response Time: The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

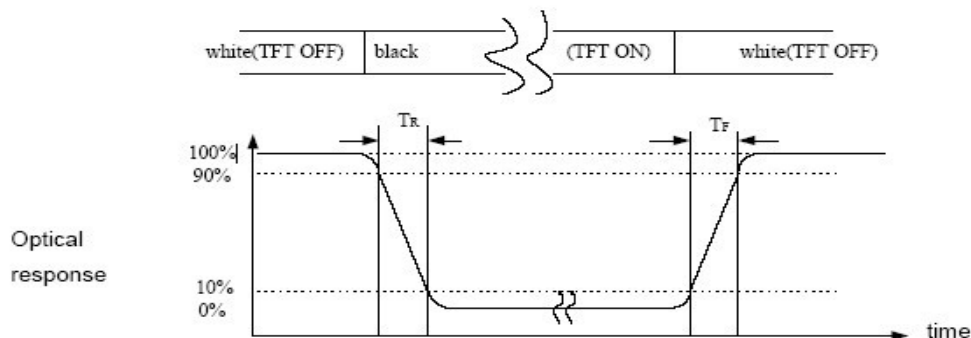




Figure 2. The definition of Response Time

Note 3: Viewing Angle

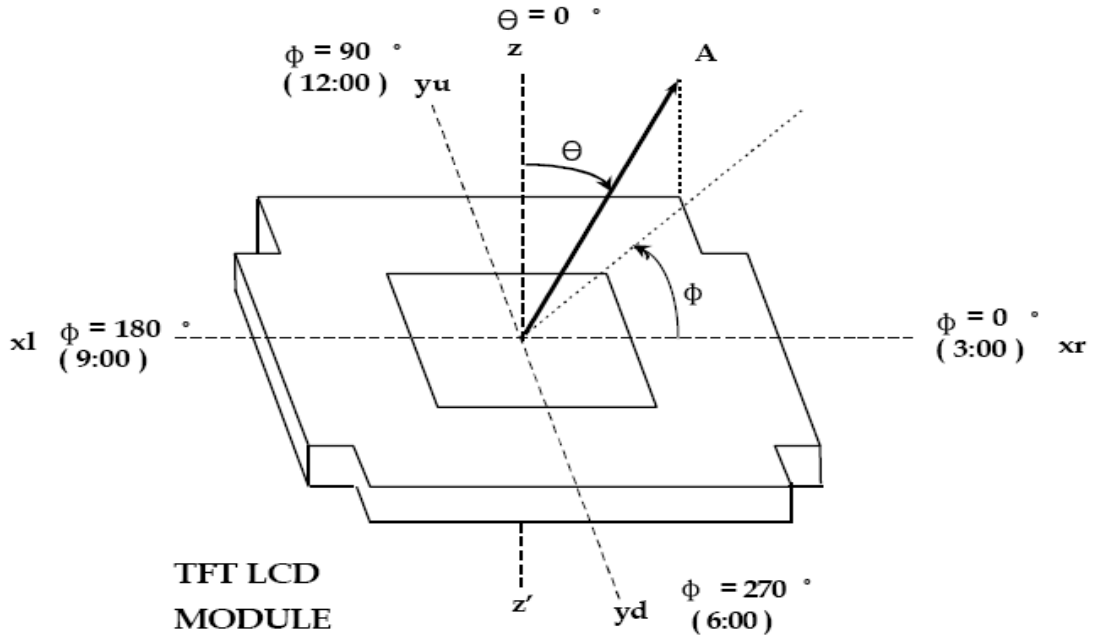


Figure 3 The definition of viewing angle

Note 4: Measurement Set-Up:

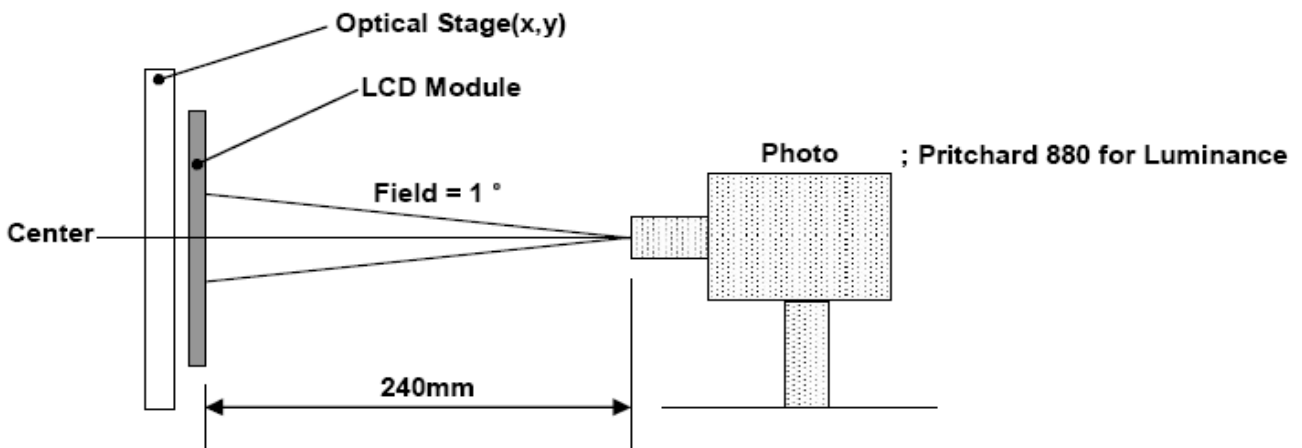


Figure 5

Measuring Condition ;

-Measuring surroundings : Dark Room

-Measuring temperature :  $T_a=25^{\circ}\text{C}$

-Adjust operating voltage to get optimum contrast at the center of the display.

-Measured value at the center point of LCD panel after more than 30 minutes while backlight turning on.

## 8. Timing Characteristics

### 8.1 High Speed Mode

Table 8: Normal Write Mode ( $V_{CC} = 2.4 \sim 3.3V$ ,  $IOV_{CC} = 1.65 \sim 3.3V$ )

Table 8: Normal Write Mode ( $V_{CC} = 2.4 \sim 3.3V$ ,  $IOV_{CC} = 1.65 \sim 3.3V$ )

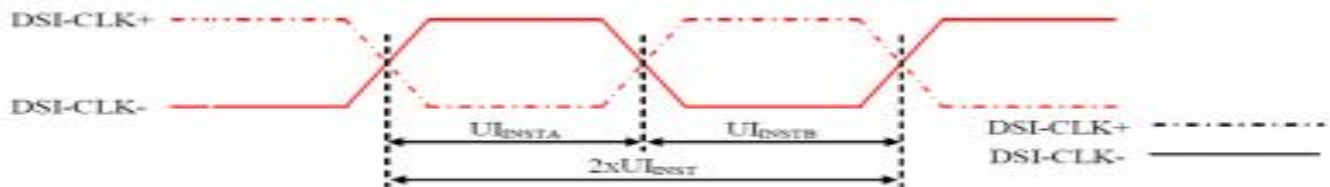


Figure 114 DSI Clock Channel Timing

Table 45 DSI Clock Channel Timing

| Signal     | Symbol                   | Parameter               | Min | Max  | Unit |
|------------|--------------------------|-------------------------|-----|------|------|
| DSI-CLK+/- | $2xUI_{INST}$            | Double UI instantaneous | 4   | 25   | ns   |
| DSI-CLK+/- | $UI_{INSTA}, UI_{INSTB}$ | UI instantaneous Half   | 2   | 12.5 | ns   |

Note:  $UI = UI_{INSTA} = UI_{INSTB}$

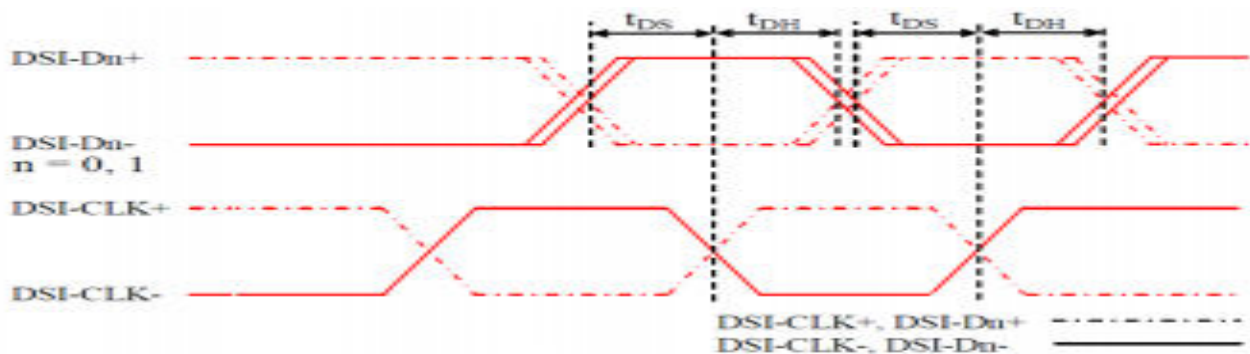


Figure 115 DSI Data to Clock Channel Timings

Table 46 DSI Data to Clock Channel Timings

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

Figure 7. High Speed Mode Timing

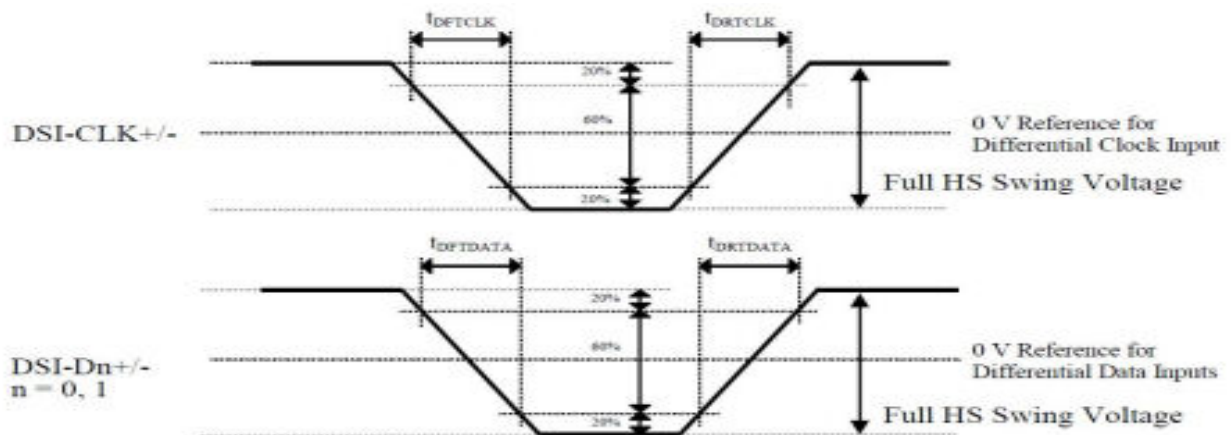


Figure 116 Rise and Fall Timings on Clock and Data Channels

Table 47 Rise and Fall Timings on Clock and Data Channels

| Parameter                        | Symbol        | Condition              | Specification |     |                | Unit |
|----------------------------------|---------------|------------------------|---------------|-----|----------------|------|
|                                  |               |                        | Min           | Typ | Max            |      |
| Differential Rise Time for Clock | $t_{DR1CLK}$  | DSI-CLK+/-             | •             | •   | 150<br>(Note ) | ps   |
| Differential Rise Time for Data  | $t_{DR1DATA}$ | DSI-Dn+/-<br>n=0 and 1 | •             | •   | 150<br>(Note ) | ps   |
| Differential Fall Time for Clock | $t_{DF1CLK}$  | DSI-CLK+/-             | •             | •   | 150<br>(Note ) | ps   |
| Differential Fall Time for Data  | $t_{DF1DATA}$ | DSI-Dn+/-<br>n=0 and 1 | •             | •   | 150<br>(Note ) | ps   |

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

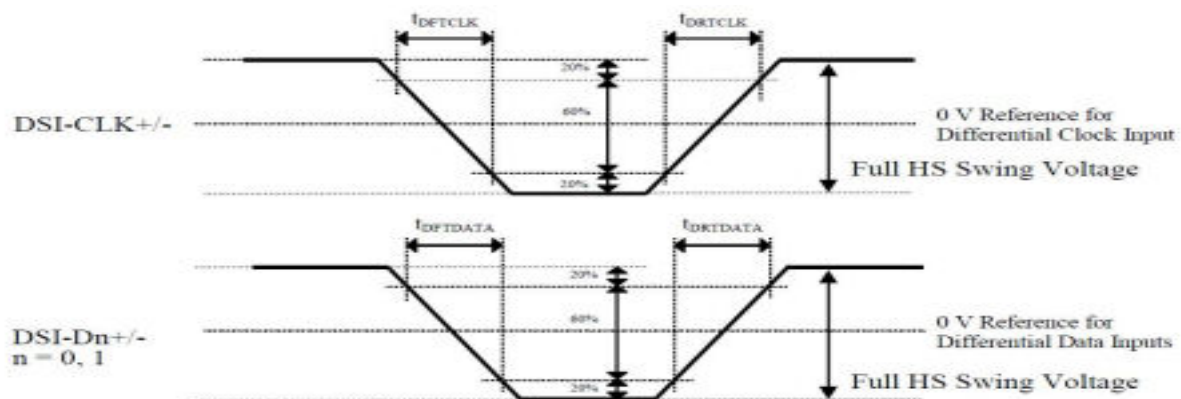


Figure 116 Rise and Fall Timings on Clock and Data Channels

Table 47 Rise and Fall Timings on Clock and Data Channels

| Parameter                        | Symbol        | Condition              | Specification |     |                | Unit |
|----------------------------------|---------------|------------------------|---------------|-----|----------------|------|
|                                  |               |                        | Min           | Typ | Max            |      |
| Differential Rise Time for Clock | $t_{DR1CLK}$  | DSI-CLK+/-             | •             | •   | 150<br>(Note ) | ps   |
| Differential Rise Time for Data  | $t_{DR1DATA}$ | DSI-Dn+/-<br>n=0 and 1 | •             | •   | 150<br>(Note ) | ps   |
| Differential Fall Time for Clock | $t_{DF1CLK}$  | DSI-CLK+/-             | •             | •   | 150<br>(Note ) | ps   |
| Differential Fall Time for Data  | $t_{DF1DATA}$ | DSI-Dn+/-<br>n=0 and 1 | •             | •   | 150<br>(Note ) | ps   |

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

## Low Power Mode

Lower Power Mode and its State Periods are illustrated for reference purposes on the Bus Turnaround (BTA) from the MPU to the Display Module (ILI9806E) sequence below.

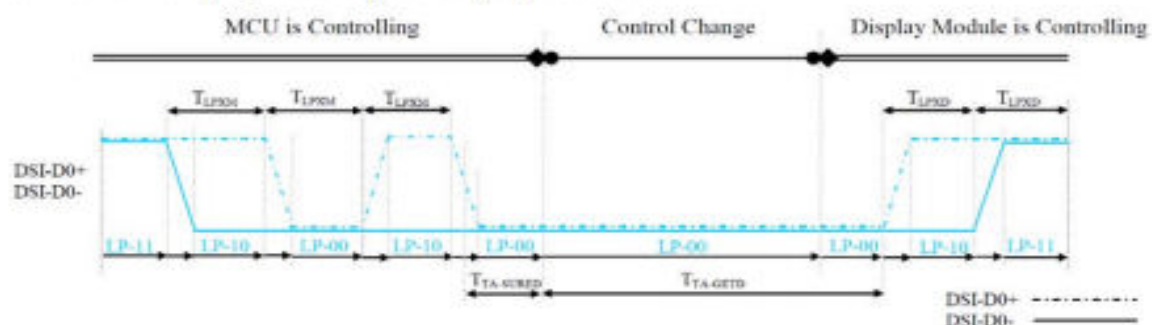


Figure 117 BTA from the MPU to the Display Module

Lower Power Mode and its State Periods are illustrated for reference purposes on the Bus Turnaround (BTA) from the Display Module (ILI9806E) to the MPU sequence below.

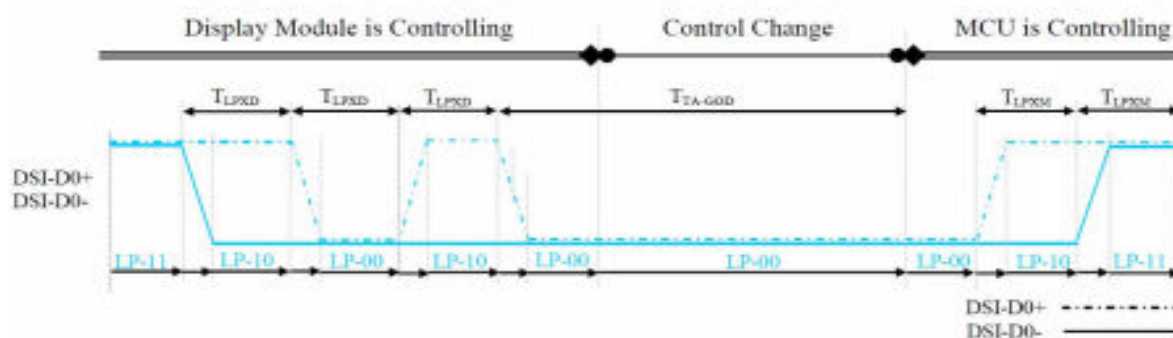


Figure 118 BTA from the Display Module to the MPU

Table 48 Low Power State Period Timings – A

| Signal    | Symbol        | Description   | Mn         | Max                 | Unit |
|-----------|---------------|---|------------|---------------------|------|
| DSI-D0+/- | $T_{LPKM}$    | Length of LP-00, LP-01, LP-10 or LP-11 periods<br>MPU → Display Module (ILI9806E) | 50         | 75                  | ns   |
| DSI-D0+/- | $T_{LPKD}$    | Length of LP-00, LP-01, LP-10 or LP-11 periods<br>Display Module (ILI9806E) → MPU | 50         | 75                  | ns   |
| DSI-D0+/- | $T_{TA-REQD}$ | Time-out before the Display Module (ILI9806E) starts driving                      | $T_{LPKD}$ | $2 \times T_{LPKD}$ | ns   |

Table 49 Low Power State Period Timings – B

| Signal    | Symbol        | Description  | Time                | Unit |
|-----------|---------------|--|---------------------|------|
| DSI-D0+/- | $T_{TA-GRD}$  | Time to drive LP-00 by Display Module (ILI9806E)   | $5 \times T_{LPKD}$ | ns   |
| DSI-D0+/- | $T_{TA-REQD}$ | Time to drive LP-00 after turnaround request = MPU | $4 \times T_{LPKD}$ | ns   |

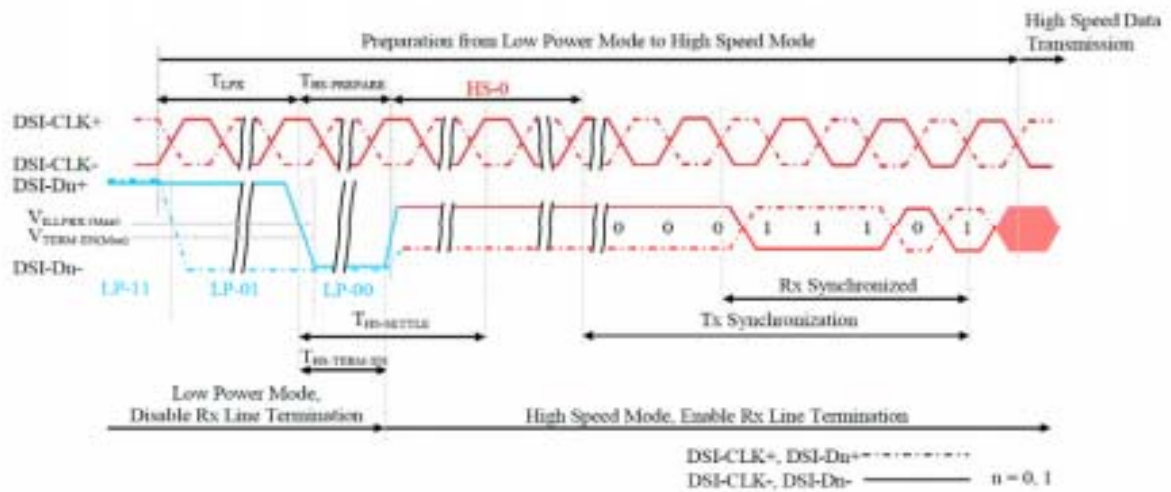


Figure 119 Data Lanes – Low Power Mode to High Speed Mode Timings

Table 50 Data Lanes – Low Power Mode to High Speed Mode Timings

| Signal                       | Symbol             | Description  | Min       | Max       | Unit |
|------------------------------|--------------------|--|-----------|-----------|------|
| DSI-Dn+ <i>k</i> , n=0 and 1 | $T_{LPx}$          | Length of any Low Power State Period   | 50        | -         | ns   |
| DSI-Dn+ <i>k</i> , n=0 and 1 | $T_{HS-prepare}$   | Time to drive LP-00 to prepare for HS Transmission   | $40+4xUI$ | $85+6xUI$ | ns   |
| DSI-Dn+ <i>k</i> , n=0 and 1 | $T_{HS-terminate}$ | Time to enable Data Lane Receiver line termination measured from when Dn crosses $V_{ILMAX}$ | -         | $35+4xUI$ | ns   |

## 8.2 Reset Operation of IC

Table 9: Reset Timing Characteristics ( $V_{CC} = 2.4\sim 3.3V$ ,  $IOV_{CC} = 1.65\sim 3.3V$ )

| Item                  | Symbol | Unit    | Min. | Typ. | Max. |
|-----------------------|--------|---------|------|------|------|
| Reset low-level width | tRES   | ms      | 1    | -    | -    |
| Reset rise time       | trRES  | $\mu s$ | -    | -    | 10   |

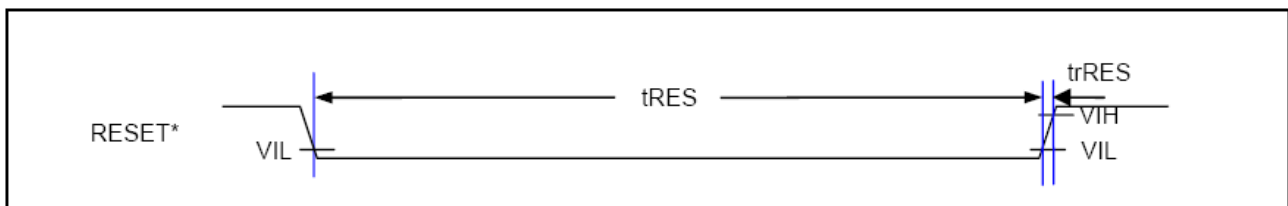


Figure 8: Reset Timing

## 9. Reliability Test Item

| Test Item                            | Sample Type        | Test Condition                     | Test result determinant gist  |
|--------------------------------------|--------------------|------------------------------------|---|
| High temperature storage             | Normal temperature | 70±3℃;96H                          | the inspection of appearance and function character.                          |
|                                      | Wide temperature   | 80±3℃;96H                          |   |
| Low temperature storage              | Normal temperature | -20±3℃;120H                        |   |
|                                      | Wide temperature   | -30±3℃;120H                        |   |
| High temperature /humidity storage   | Normal temperature | 50℃±3℃,90%±3%RH;96H                |   |
|                                      | Wide temperature   | 60℃±3℃,90%±3%RH;96H                |   |
| High temperature operation           | Normal temperature | 60±3℃;96H                          | No objection of the function character; no fatal objection of the appearance. |
|                                      | Wide temperature   | 70±3℃;96H                          |   |
| Low temperature operation            | Normal temperature | 0±3℃;96H                           |   |
|                                      | Wide temperature   | -20±3℃;96H                         |   |
| High temperature /humidity operation | Normal temperature | 40℃±3℃,90%±3%RH;96H                |   |
|                                      | Wide temperature   | 50℃±3℃,90%±3%RH;96H                |   |
| Temperature Shock                    | Normal temperature | -20±3℃,30min→70±3℃,30min;10cycle   | inspect the objections appearance、function & the whole structure              |
|                                      | Wide temperature   | -30±3℃,30min<br>80±3,30min;10cycle | The inspection of appearance、function & the whole structure                   |

## **10. Suggestions for using LCD modules**

### **10.1 Handling of LCM**

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated ,clean it with soft cloth. If the LCM is severely contaminated , use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer . The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don't disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD modules.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
  - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

### **10.2 Storage**

1. Store in an ambient temperature of 5 to 45 °C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

## **11. Packing (Reference only)**

### **Packing Method**

- END -