



**WINSTAR Display Co.,Ltd.**  
**華凌光電股份有限公司**



# Winstar Display Co., LTD

## 華凌光電股份有限公司



WEB: <https://www.winstar.com.tw> E-mail: sales@winstar.com.tw

### SPECIFICATION

**CUSTOMER :** \_\_\_\_\_

**MODULE NO.:** WF35UTYAIDNNO#

|  |   |
|--|---|
| <p><b>APPROVED BY:</b><br/>( FOR CUSTOMER USE ONLY )</p> | <p><b>PCB VERSION:</b> _____ <b>DATA:</b> _____</p> |
|--|---|

| SALES BY                       | APPROVED BY | CHECKED BY | PREPARED BY |
|--------------------------------|-------------|------------|-------------|
|                                |             |            | 葉虹蘭         |
| <b>ISSUED DATE: 2020/08/27</b> |             |            |             |

TFT Display Inspection Specification: <https://www.winstar.com.tw/technology/download.html>

Precaution in use of TFT module: <https://www.winstar.com.tw/technology/download/declaration.html>



**RECORDS OF REVISION**

DOC. FIRST ISSUE

| VERSION | DATE       | REVISED PAGE NO. | SUMMARY                   |
|---------|------------|------------------|---------------------------|
| 0       | 2017/08/03 |                  | First issue               |
| A       | 2018/04/25 |                  | Modify AC CHARATERISTICS. |
| B       | 2018/05/07 |                  | Add RGB Interface.        |
| C       | 2020/08/27 |                  | Modify backlight.         |

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# 1.Module Classification Information

W F 35 U T Y A I D N N 0 #  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

|   |   |   |  |         |   |  |    |                                    |               |                                |   |         |
|---|---|---|--|---------|---|--|----|------------------------------------|---------------|--------------------------------|---|---------|
| ① | Brand : WINSTAR DISPLAY CORPORATION   |   |  |         |   |  |    |                                    |               |                                |   |         |
| ② | Display Type : F→TFT Type, J→Custom TFT   |   |  |         |   |  |    |                                    |               |                                |   |         |
| ③ | Display Size : 3.5" TFT   |   |  |         |   |  |    |                                    |               |                                |   |         |
| ④ | Model serials no.   |   |  |         |   |  |    |                                    |               |                                |   |         |
| ⑤ | Backlight Type :  | F→CCFL, White<br>S→LED, High Light White  |  |         |   | T→LED, White<br>Z→Nichia LED, White  |    |                                    |               |                                |   |         |
| ⑥ | LCD Polarize Type/<br>Temperature range/ Gray Scale Inversion Direction   | A→Transmissive, N.T, IPS TFT<br>C→Transmissive, N. T, 6:00 ;<br>F→Transmissive, N.T,12:00 ;<br>I→Transmissive, W. T, 6:00<br>K→Transflective, W.T,12:00<br>L→Transmissive, W.T,12:00<br>N→Transmissive, Super W.T, 6:00 |  |         |   | Q→Transmissive, Super W.T, 12:00<br>R→Transmissive, Super W.T, O-TFT<br>V→Transmissive, Super W.T, VA TFT<br>W→Transmissive, Super W.T, IPS TFT<br>X→Transmissive, W.T, VA TFT<br>Y→Transmissive, W.T, IPS TFT<br>Z→Transmissive, W.T, O-TFT |    |                                    |               |                                |   |         |
| ⑦ | A : TFT LCD<br>B : TFT+SCREW HOLES+CONTROL BOARD<br>C : TFT+ SCREW HOLES +A/D BOARD<br>D : TFT+ SCREW HOLES +A/D BOARD+CONTROL BOARD<br>E : TFT+ SCREW HOLES +POWER BOARD |   |  |         | F : TFT+CONTROL BOARD<br>G : TFT+ SCREW HOLES<br>H : TFT+D/V BOARD<br>I : TFT+ SCREW HOLES +D/V BOARD<br>J : TFT+POWER BD |  |    |                                    |               |                                |   |         |
| ⑧ | Resolution:   |   |  |         |   |  |    |                                    |               |                                |   |         |
|   | A   | 128160  | B  | 320234  | C   | 320240   | D  | 480234                             | E             | 480272                         | F | 640480  |
|   | G   | 800480  | H  | 1024600 | I   | 320480   | J  | 240320                             | K             | 800600                         | L | 240400  |
|   | M   | 1024768   | N  | 128128  | P   | 1280800  | Q  | 480800                             | R             | 640320                         | S | 480128  |
|   | T   | 800320  | U  | 8001280 | V   | 176220   | W  | 1280398                            | X             | 1024250                        | Y | 1920720 |
|   | Z   | 800200  | 2  | 1024324 | 3   | 7201280  | 4  | 19201200                           | 5             | 1366768                        | 6 | 1280320 |
| ⑨ | D: Digital L : LVDS M:MIPI  |   |  |         |   |  |    |                                    |               |                                |   |         |
| ⑩ | Interface:  |   |  |         |   |  |    |                                    |               |                                |   |         |
|   | N   | Without control board   |  |         | A   | 8Bit   |    | B                                  | 16Bit         |                                | H | HDMI    |
|   | I   | I2C Interface   |  |         | R   | RS232  |    | S                                  | SPI Interface |                                | U | USB     |
| ⑪ | TS:   |   |  |         |   |  |    |                                    |               |                                |   |         |
|   | N   | Without TS  |  |         | T   | Resistive touch panel  |    |                                    | C             | Capacitive touch panel (G-F-F) |   |         |
|   | G   | Capacitive touch panel (G-G)  |  |         |   |  | C1 | Capacitive touch panel (G-F-F)+OCA |               |                                |   |         |
|   | C2  | Capacitive touch panel (G-F-F)+OCR  |  |         |   |  | G1 | Capacitive touch panel (G-G)+OCA   |               |                                |   |         |
|   | G2  | Capacitive touch panel (G-G)+OCR  |  |         |   |  | B  | CTP+GG+USB                         |               |                                |   |         |
| ⑫ | Version: X:Raspberry pi   |   |  |         |   |  |    |                                    |               |                                |   |         |
| ⑬ | Special Code  |   | #:Fit in with ROHS directive regulations |         |   |  |    |                                    |               |                                |   |         |

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

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## **2.Summary**

TFT 3.5 is a IPS transmissive type color active matrix TFT liquid crystal display that use amorphous silicon TFT as switching devices. This module is a composed of a TFT\_LCD module, It is usually designed for industrial application and this module follows RoHs.

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### **3. General Specifications**

| <b>Item</b>      | <b>Dimension</b>                            | <b>Unit</b> |
|------------------|---|-------------|
| Size             | 3.5   | inch        |
| Dot Matrix       | 320 x RGBx 480(TFT)                         | dots        |
| Module dimension | 54.5 (W) x83.0 (H) x 2.46(D)                | mm          |
| Active area      | 48.96 x 73.44                               | mm          |
| LCD type         | TFT, Normally Black, Transmissive           |             |
| View Direction   | Wide View                                   |             |
| Aspect Ratio     | Portrait                                    |             |
| TFT Driver IC    | ILI9488 or Equivalent                       |             |
| TFT Interface    | MCU 8/16/18-bit, 3-SPI ,RGB interface+3-SPI |             |
| \Backlight Type  | LED,Normally White                          |             |
| With /Without TP | Without TP                                  |             |
| Surface          | Anti-Glare                                  |             |

\*Color tone slight changed by temperature and driving voltage.



## **4. Absolute Maximum Ratings**

| Item                  | Symbol | Min | Typ | Max | Unit |
|-----------------------|--------|-----|-----|-----|------|
| Operating Temperature | TOP    | -20 | —   | +70 | °C   |
| Storage Temperature   | TST    | -30 | —   | +80 | °C   |

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp.  $\leq 60^{\circ}\text{C}$ , 90% RH MAX. Temp.  $> 60^{\circ}\text{C}$ , Absolute humidity shall be less than 90% RH at  $60^{\circ}\text{C}$

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# 5. Electrical Characteristics

## 5.1. Operating conditions:

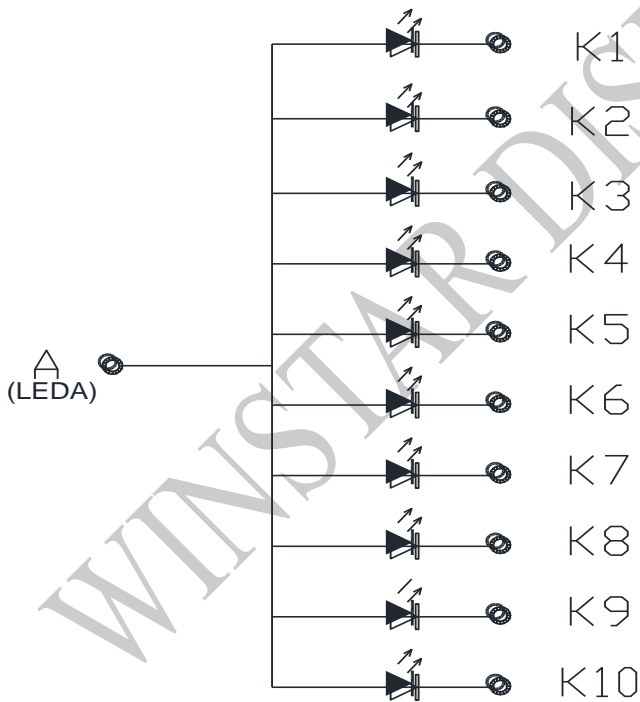
| Item                       | Symbol | Condition              | Min | Typ     | Max | Unit |
|----------------------------|--------|------------------------|-----|---------|-----|------|
| Supply Voltage for digital | IOVCC  | —                      | —   | 1.8/2.8 | 3.3 | V    |
| Supply Voltage for analog  | VCI    | —                      | —   | 2.8     | 3.3 | V    |
| Power Supply for Current   | ICC    | IOVCC=VCI<br>=VCC=3.3V | —   | 13.6    | —   | mA   |

## 5.2. LED driving conditions

| Parameter     | Symbol | Min | Typ   | Max | Unit | Remark   |
|---------------|--------|-----|-------|-----|------|----------|
| LED current   | —      | —   | 160   | —   | mA   | —        |
| LED voltage   | LEDA   | 2.7 | 3.2   | 3.4 | V    | Note 1   |
| LED Life Time | —      | —   | 50000 | —   | Hr   | Note 2,3 |

Note 1 : There are 1 Groups LED

Note 2 : Ta = 25°C



(K1~K10 connector to LEDK)

Note 3 : Brightness to be decreased to 50% of the initial value

## 6.DC CHARATERISTICS

| Parameter                | Symbol   | Rating |     |        | Unit | Condition |
|--------------------------|----------|--------|-----|--------|------|-----------|
|                          |          | Min    | Typ | Max    |      |           |
| Low level input voltage  | $V_{IL}$ | 0      | -   | 0.2VCC | V    |           |
| High level input voltage | $V_{IH}$ | 0.8VCC | -   | VCC    | V    |           |

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# 7.AC CHARACTERISTICS

## 7.1. DBI Type C Option 1 (3-Line Serial Interface)

The 3-line/9-bit serial bus interface of the ILI9488 can be used by setting external pin IM [2:0] as 101. Figure 1 describes an interface with 8080 MCU system interface.

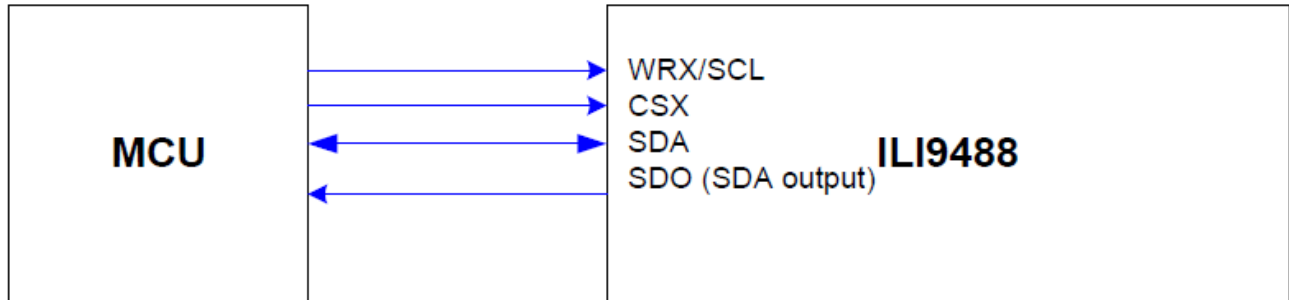


Figure 1: 3-Line Serial Interface

The available display data formats are:

\*8 colors, RGB 1, 1, 1 bits input (set Standard Command 3Ah, DBI [2:0] as 001)

\*262K-Colors, RGB 6, 6, 6 bits input data (set Standard Command 3Ah, DBI [2:0] as 110)

### 7.1.1 SPI Data for 3-bit/pixel (RGB 1-1-1 Bits Input), 8-color

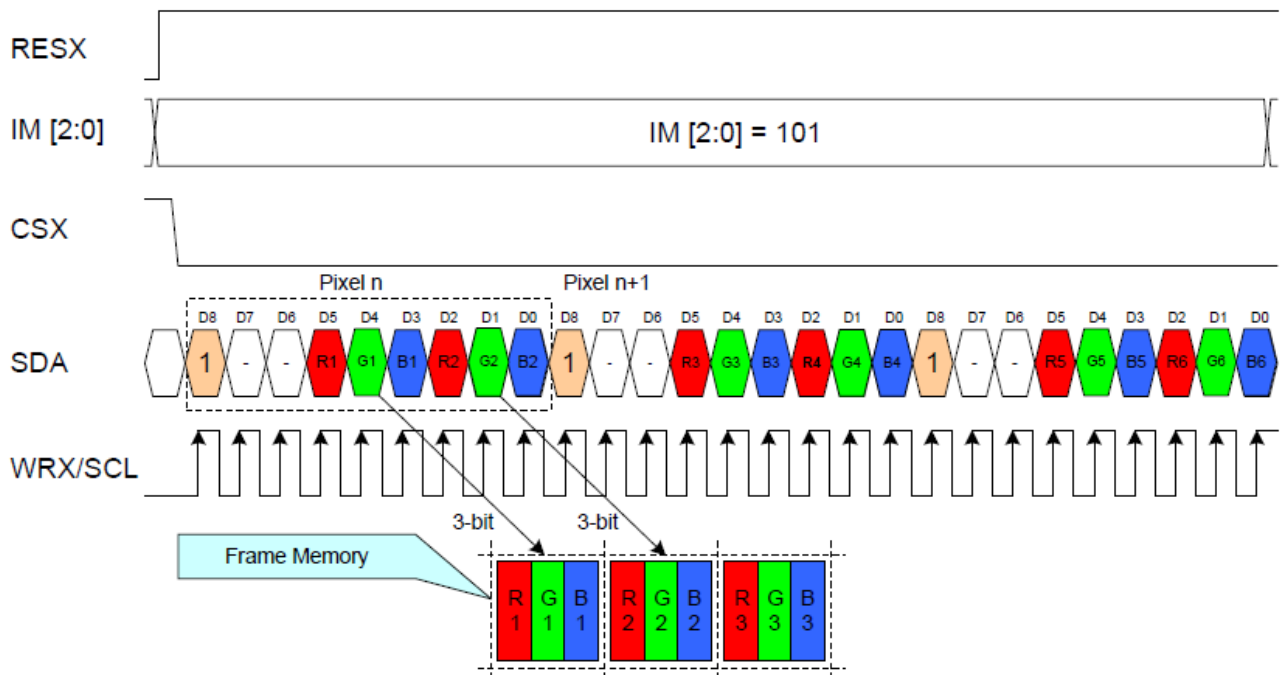


Figure 2: SPI Data for 3 bit/pixel (RGB 1-1-1 Bits Input), 8-color

Notes:

1. One pixel data contains 3-bit color depth information.

### 7.1.2. SPI Data for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

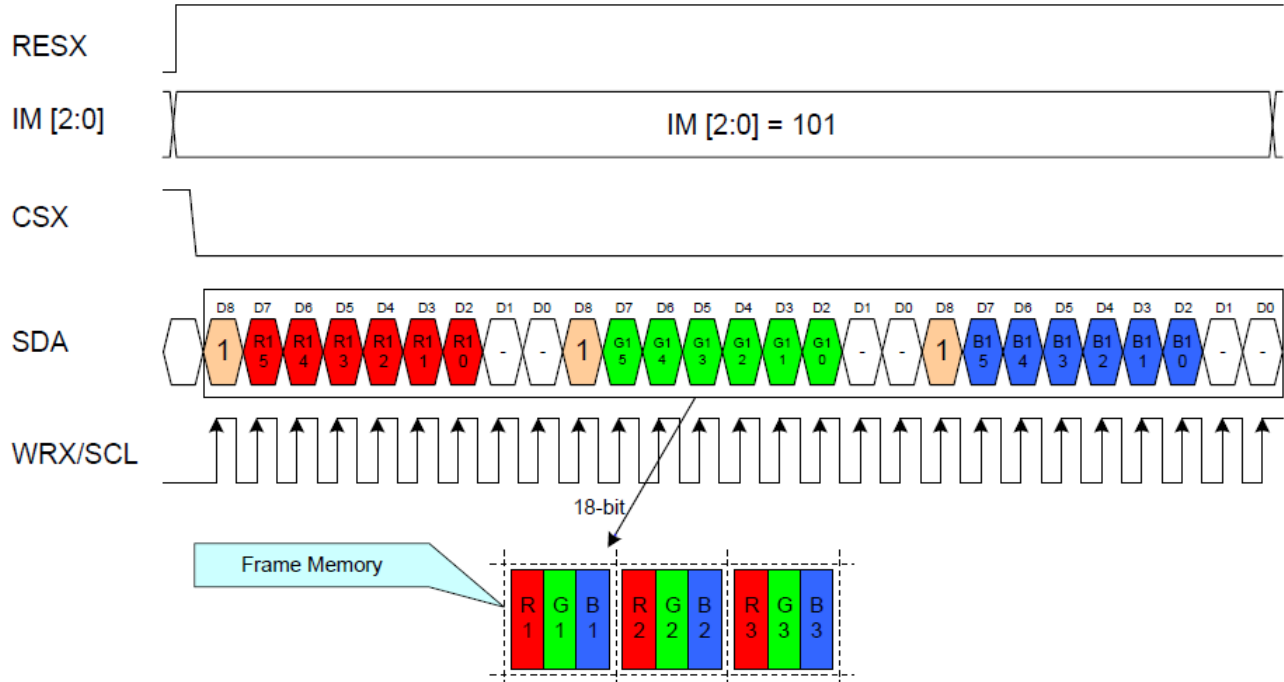


Figure 3: SPI Data for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

#### Notes:

1. One pixel data contains 18-bit color depth information.
2. The most significant bits are: R x 5, G x 5, and B x 5.
3. The least significant bits are: R x 0, G x 0, and B x 0.

#### Read data through 3-line SPI mode

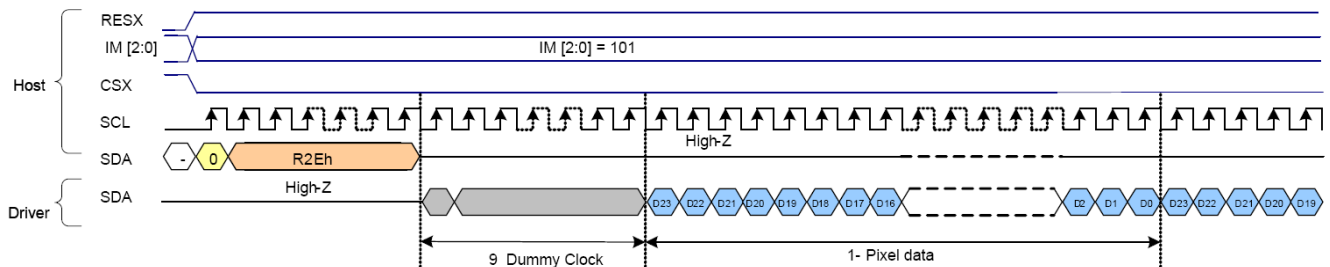


Figure 4: 3-Line SPI Mode Read Data

Note: „-“ = void

## 7.2. 8-bit Parallel MCU Interface

The DBI TYPE B 8-bit parallel bus interface of the ILI9488 is used by setting the external pin IM [2:0] as 011. Figure 5 shows this system interface.

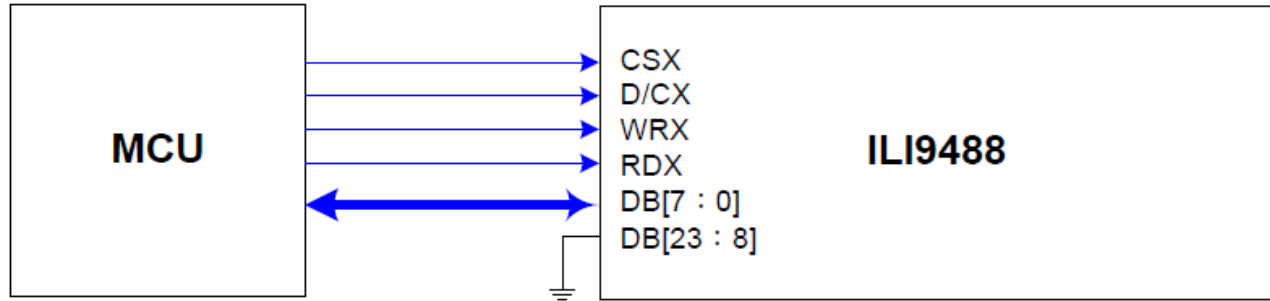


Figure 5: 8-bit Parallel MCU Interface

The available display data formats are:

\*65K-Colors, RGB 5, 6, 5 bits input data (set Standard Command 3Ah, DBI [2:0] as 101)

\*262K-Colors, RGB 6, 6, 6 bits input data (set Standard Command 3Ah, DBI [2:0] as 110)

### 7.2.1. 8-bit Data Bus for 16-bit/pixel (RGB 5-6-5 Bits Input), 65K-color

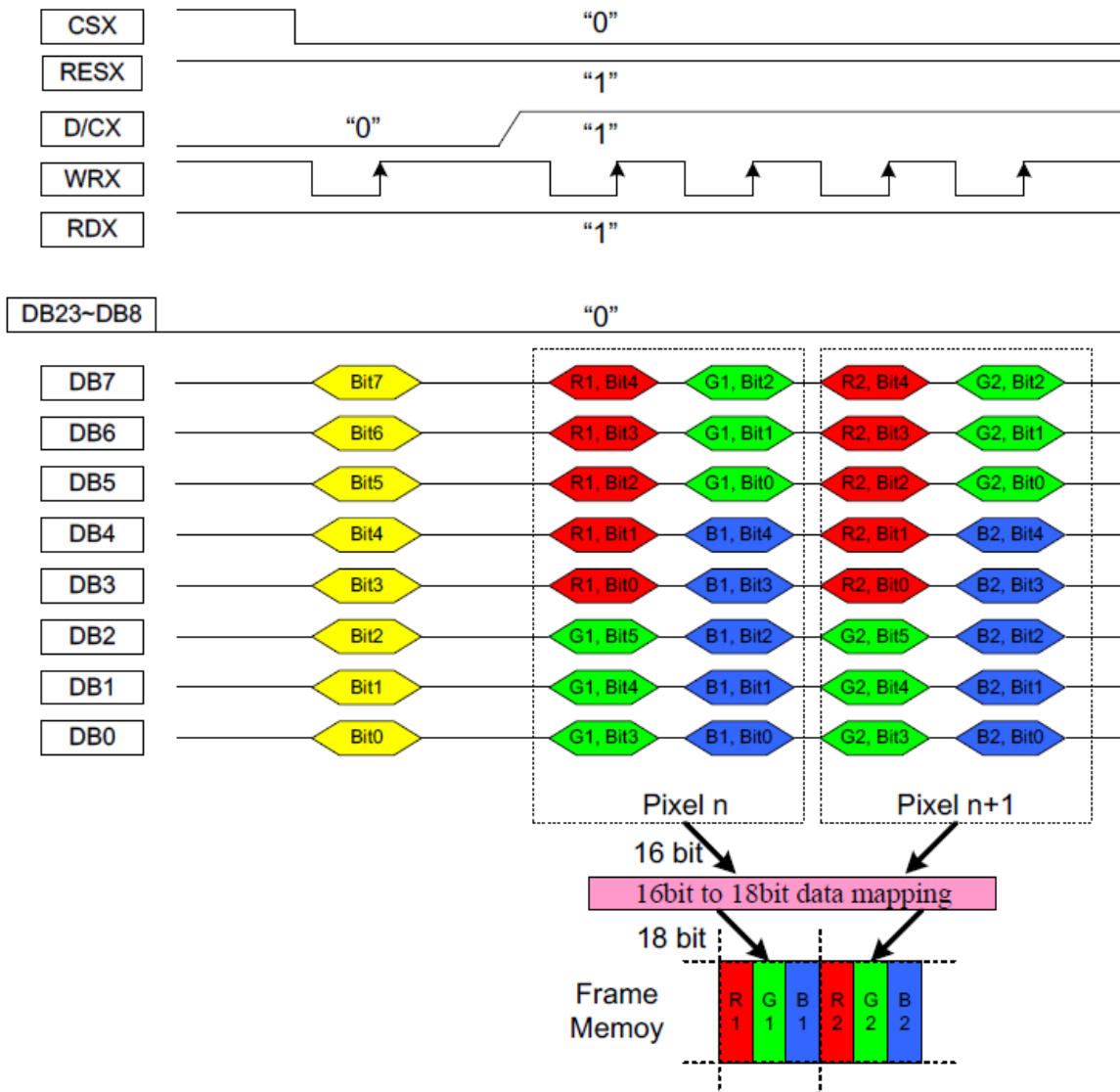


Figure 6: 8-bit Data Bus for 16-bit/pixel (RGB 6-5-6 Bits Input), 65K-color

Notes:

1. The data order is as follows: MSB = DB7, LSB = DB0, and picture data is MSB = Bit 5, LSB = Bit 0 for Green data, and MSB = Bit 4, LSB = Bit 0 for Red and Blue data.
2. 2-times transfer is used to transmit 1 pixel data to the 16-bit color depth information.

### 7.2.2. 8-bit Data Bus for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

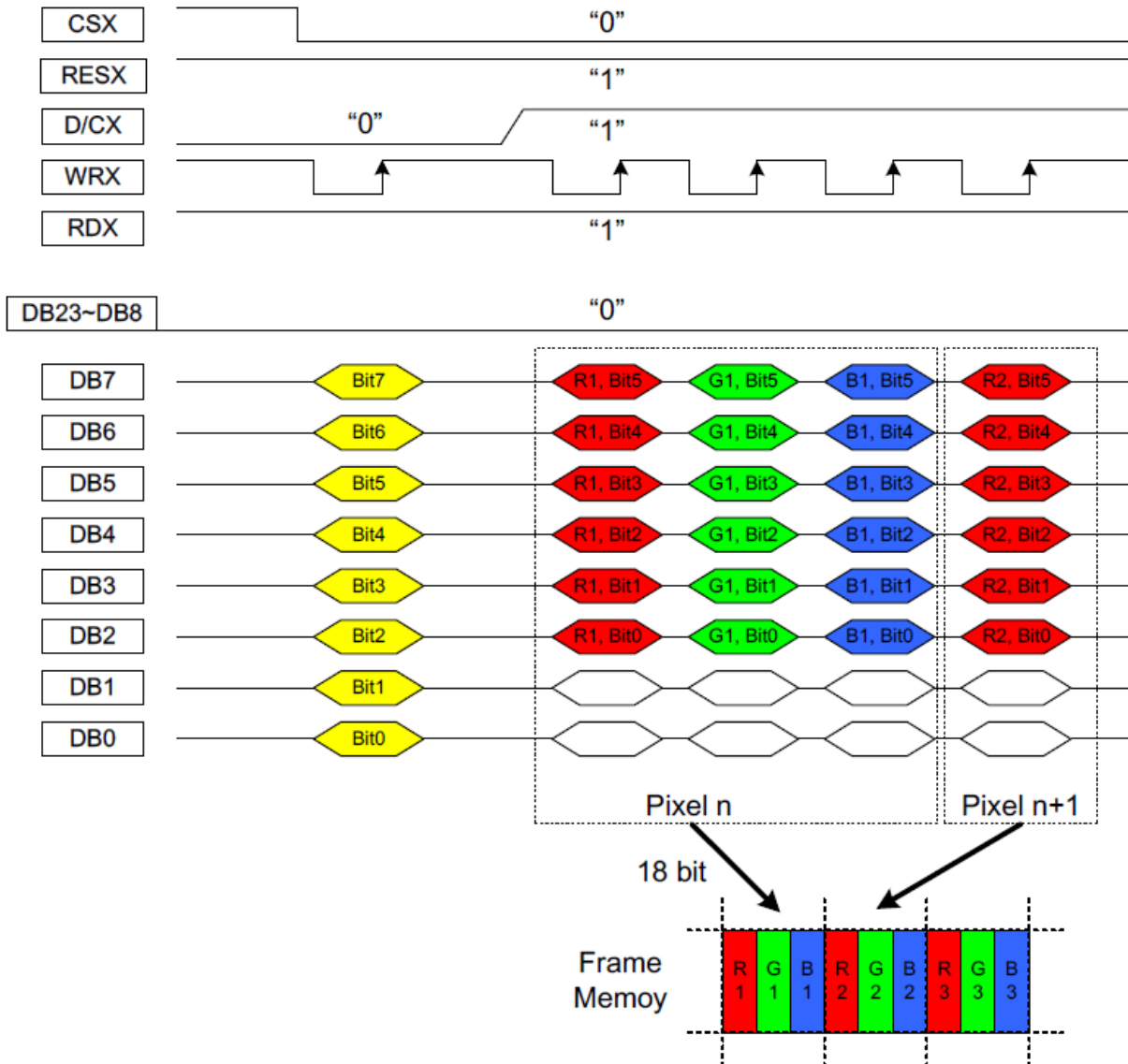


Figure 7: 8-bit Data Bus for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

Notes:

1. The data order is as follows: MSB = DB7, LSB = DB0, and picture data is MSB = Bit 5, LSB = Bit 0 for Green, Red and Blue data.
2. 3-times transfer is used to transmit 1 pixel data to the 18-bit color depth information.

### 7.3. 16-bit Parallel MCU Interface

The 8080-system 16-bit parallel bus interface of the ILI9488 can be used by setting external pin IM [2:0] as 010.

Figure 8 shows this system interface.

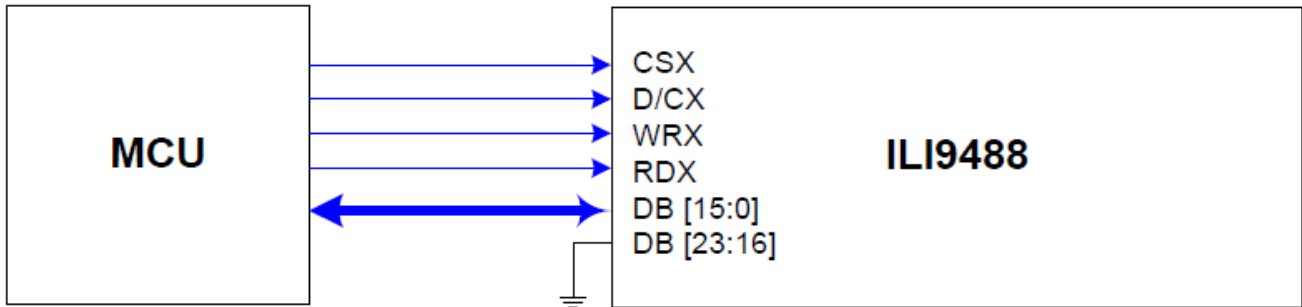


Figure 8: 16-bit Parallel MCU Interface

The available display data formats are:

65K-Colors, RGB 5, 6, 5 bits input data (set Standard Command 3Ah, DBI [2:0] as 101)

262K-Colors, RGB 6, 6, 6 bits input data (set Standard Command 3Ah, DBI [2:0] as 110)

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### 7.3.1 16-bit Data Bus for 16-bit/pixel (RGB 5-6-5 Bits Input), 65K-color

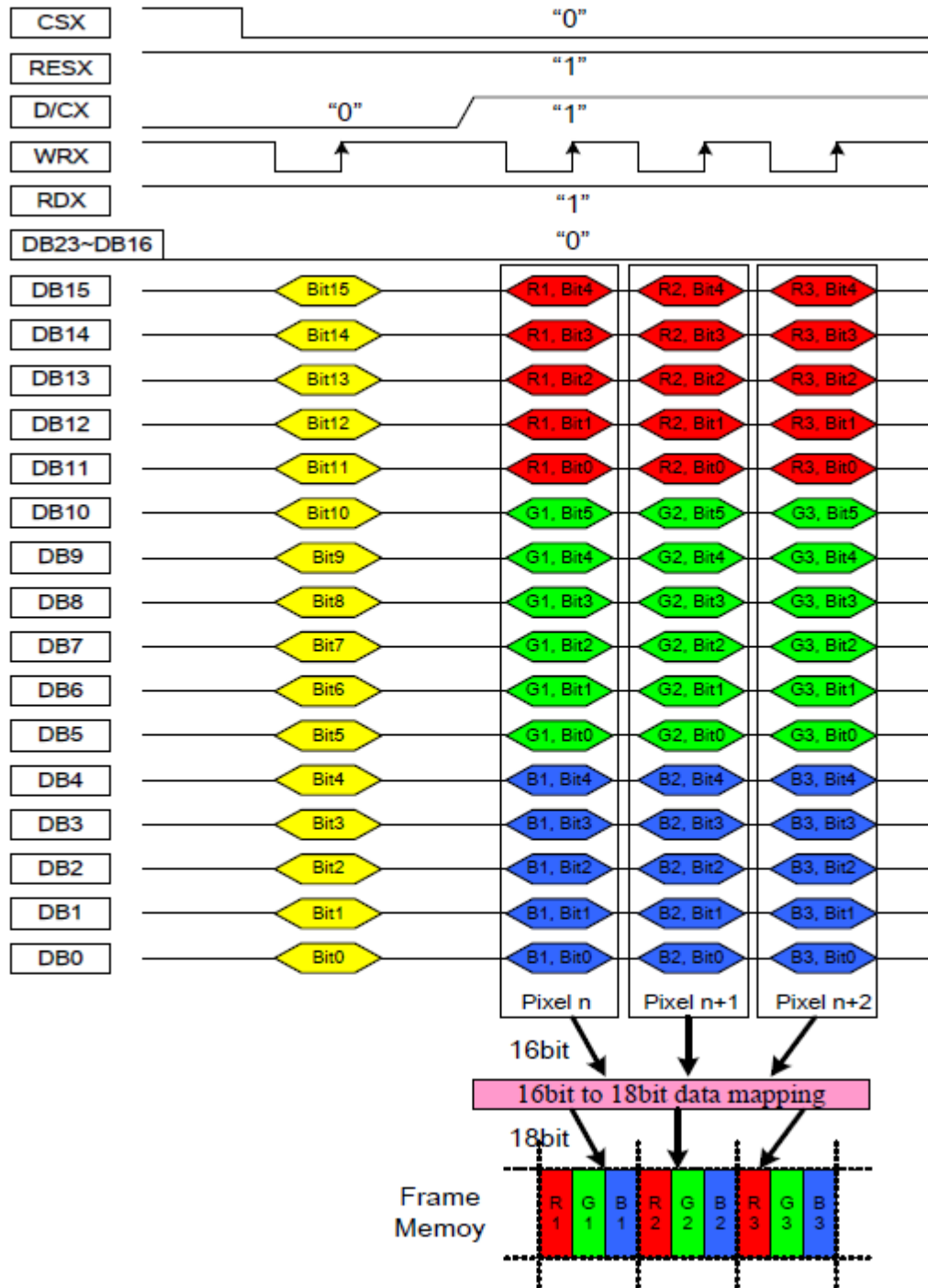


Figure 9: 16-bit Data Bus for 16-bit/pixel (RGB 5-6-5 Bits Input), 65K-color

Notes:

1. The data order is as follows: MSB = DB15, LSB = DB0, and picture data is MSB = Bit 5, LSB = Bit 0 for Green data, and MSB = Bit 4, LSB = Bit0 for Red and Blue data.
2. 1-time transfer is used to transmit 1 pixel data to the 16-bit color depth information.

### 7.3.2 16-bit Data Bus for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

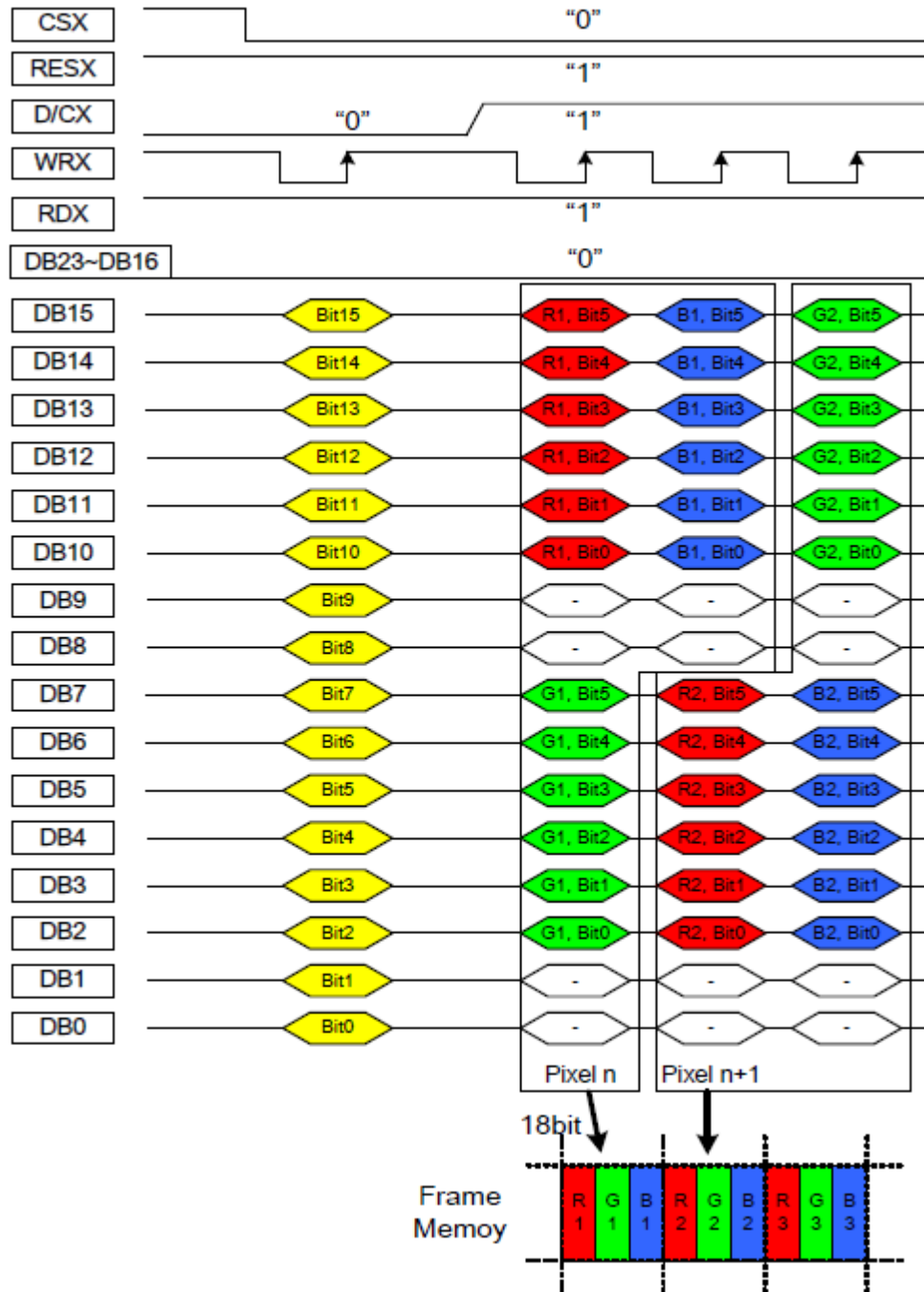


Figure 10: 16-bit Data Bus for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

Notes:

1. The data order is as follows: MSB = DB15, LSB = DB0, and picture data is MSB = Bit 5, LSB = Bit 0 for Green, Red and Blue data.
2. 3-times transfer is used to transmit 2 pixel data to the 18-bit color depth information.

#### 7.4. 18-bit Parallel MCU Interface

The 8080-system 18-bit parallel bus interface of the ILI9488 can be used by setting external pin IM [2:0] as 000.

Figure 11 shows this system interface.

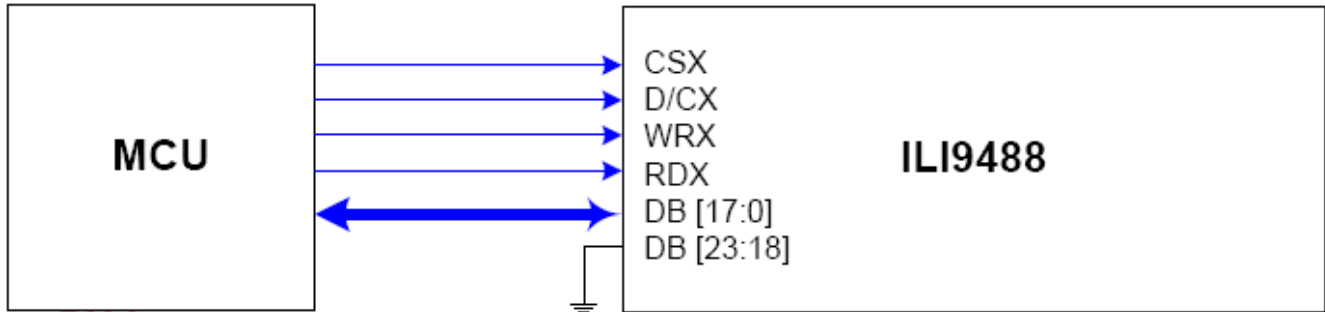


Figure 11: 18-bit Parallel MCU Interface

The available display data formats is:

262K-Colors, RGB 6, 6, 6 bits input data (set Standard Command 3Ah, DBI [2:0] as 110)

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### 7.4.1 18-bit Data Bus for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

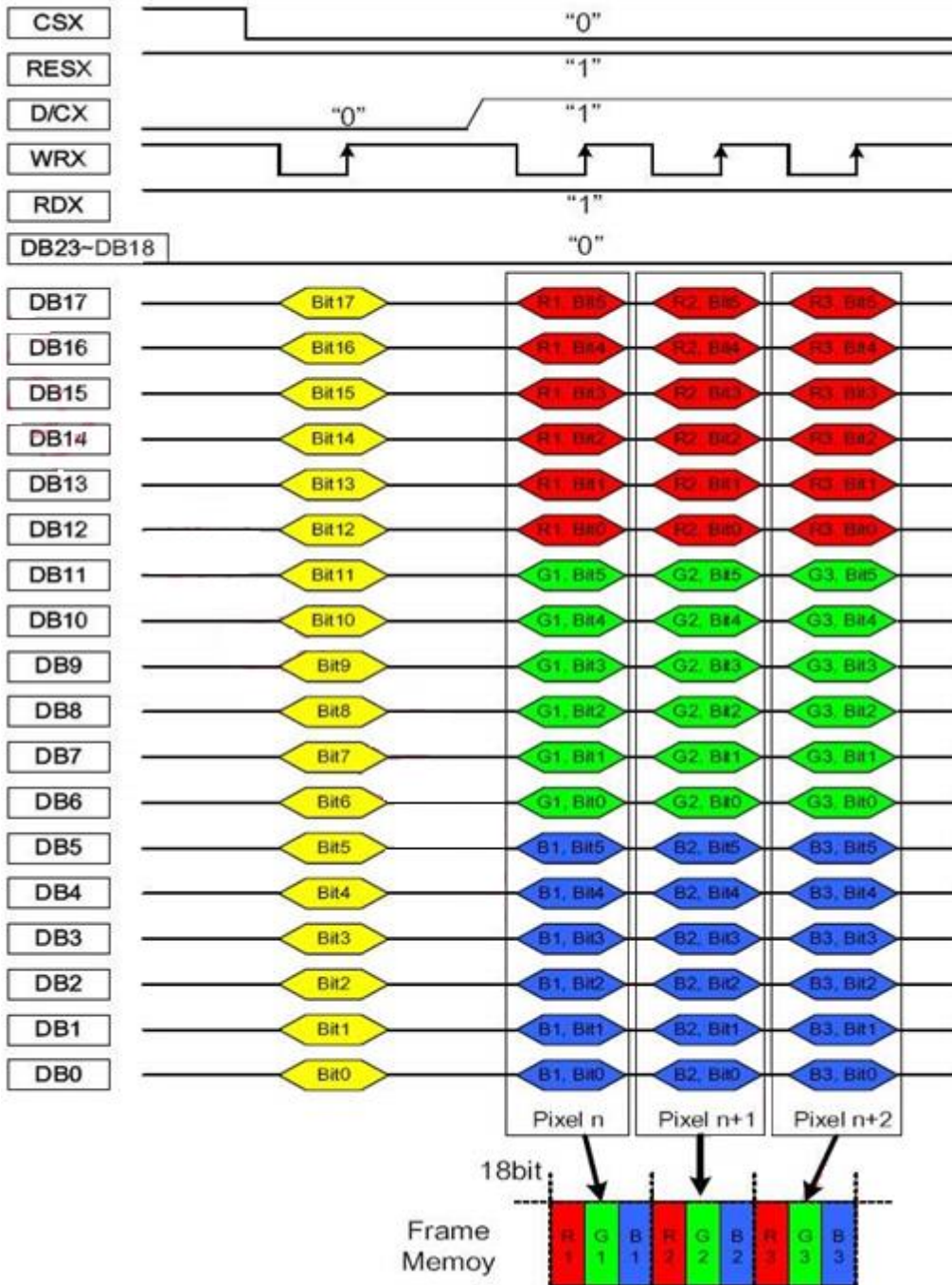


Figure 12: 18-bit Data Bus for 18-bit/pixel (RGB 6-6-6 Bits Input), 262K-color

**Notes:**

1. The data order is as follows: MSB = DB17, LSB = DB0, and picture data is MSB = Bit 5, LSB = Bit 0 for Green, Red and Blue data.
2. 1-times transfer is used to transmit 1 pixel data to the 18-bit color depth information.

## 7.5. DPI (RGB Interface)

The DPI can display moving pictures by two ways: rewrite into the GRAM and transmit directly to the shift register. The selection is set by the register BPGRAM (bypass GRAM) and RM bit. The RM bit selects an interface for the access operation of the Frame Memory. For the DPI, RM should be set as 1.

| BPGRAM | Display Data Path        |
|--------|--------------------------|
| 1      | Direct to shift register |
| 0      | Write into Memory        |
| RM     | Interface for RAM access |
| 0      | System interface         |
| 1      | RGB interface            |

The DM bit selects the clock operation mode. It allows switching between display operations in synchronization with the internal oscillation clock. If DM=1, the external DOTCLK cannot be stopped unless it enters the Sleep-In mode.

| DM | RGB Interface Operating Clock Selection |
|----|---|
| 0  | Internal system clock                   |
| 1  | RGB interface (DOTCLK)                  |

### 7.5.1 RGB Interface Selection

The DPI can be selected by the RCM bit. When the RCM is set to 0, the DE mode is selected by VSYNC, HSYNC, DOTCLK, ENABLE, and DB[17:0] (or DB[15:0]) pins.

When RCM is set to 1, the SYNC mode is selected by VSYNC, HSYNC, DOTCLK, and DB[17:0] (or DB[15:0]) pins. It supports several pixel formats that can be selected by DPI[2:0] bits in Pixel Format Set (R3Ah) command. The selection of a given interface is done by DPI[2:0], as shown in Table 1 and Figure 13.

Table 1: DPI Interface Selection

| RCM | DPI [2:0] |   |   | RGB Interface Mode                 | RGB Mode   | Used Pins                               |
|-----|-----------|---|---|------------------------------------|--|---|
| 0   | 1         | 1 | 0 | 18-bit RGB interface (262K colors) | <b>DE Mode</b><br>Valid data is determined by the ENABLE signal.   | VSYNC, HSYNC, ENABLE, DOTCLK, DB [17:0] |
| 0   | 1         | 0 | 1 | 16-bit RGB interface (65K colors)  |  | VSYNC, HSYNC, ENABLE, DOTCLK, DB [15:0] |
| 1   | 1         | 1 | 0 | 18-bit RGB interface (262K colors) | <b>SYNC Mode</b><br>In the SYNC mode, ENABLE signal is ignored; blanking porch is determined by B5h command. | VSYNC, HSYNC, DOTCLK, DB [17:0]         |
| 1   | 1         | 0 | 1 | 16-bit RGB interface (65K colors)  |  | VSYNC, HSYNC, DOTCLK, DB [15:0]         |

18-bit DPI interface connection (DB [17:0] is used): set pixel format DPI [2:0] as 110

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DB23 | DB22 | DB21 | DB20 | DB19 | DB18 | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9  | DB8  | DB7  | DB6  | DB5  | DB4  | DB3  | DB2  | DB1  | DB0  |
|      |      |      |      |      |      | R[5] | R[4] | R[3] | R[2] | R[1] | R[0] | G[5] | G[4] | G[3] | G[2] | G[1] | G[0] | B[5] | B[4] | B[3] | B[2] | B[1] | B[0] |

16-bit DPI interface connection (DB [15:0] is used): set pixel format DPI [2:0] as 101

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DB23 | DB22 | DB21 | DB20 | DB19 | DB18 | DB17 | DB16 | DB15 | DB14 | DB13 | DB12 | DB11 | DB10 | DB9  | DB8  | DB7  | DB6  | DB5  | DB4  | DB3  | DB2  | DB1  | DB0  |
|      |      |      |      |      |      |      |      | R[4] | R[3] | R[2] | R[1] | R[0] | G[5] | G[4] | G[3] | G[2] | G[1] | G[0] | B[4] | B[3] | B[2] | B[1] | B[0] |

Figure 13: RGB Interface 18/16 Pixel Format Selection

The Pixel clock (DOTCLK) runs all the time without stop. It is used to enter VSYNC, HSYNC, ENABLE and DB[17:0] (or DB[15:0]) states when there is a rising edge of the DOTCLK. The DOTCLK cannot be used as the internal clock for other functions of the display module.

Vertical synchronization (VSYNC) is used to indicate when a new frame of the display is received. This is low enable and its state is read to the display module by a rising edge of the DOT CLK signal.

Horizontal synchronization (HSYNC) is used to indicate when a new line of the frame is received. This is low enable and its state is read to the display module by a rising edge of the DOT CLK signal.

Data Enable (ENABLE) is used to indicate when the RGB information that should be transferred in the display is received. This is a high enable, and its state is read to the display module by a rising edge of the DOTCLK signal. DB[17:0] (or DB[15:0]) is used to indicate what is the information of the image that is transferred on the display (when ENABLE = 0 (low) and there is a rising edge of DOTCLK). DB[17:0] (or DB[15:0]) can be 0 (low) or 1 (high). These lines are read by a rising edge of the DOT CLK signal. In RGB interface modes, the input display data is written to GRAM first then outputs the corresponding source voltage according to the gray data from GRAM.

## 7.5.2 RGB Interface Timing

DPI Parameters Setting(BYPASS bit = 0)

| Parameters                 | Symbols | Min. | Typ. | Max.               | Units  |
|----------------------------|---------|------|------|--------------------|--------|
| Horizontal Synchronization | H_Low   | 3    | -    | H_Low < HBP        | DOTCLK |
| Horizontal Back Porch      | HBP     | 3    | -    | 192                | DOTCLK |
| Horizontal Front Porch     | HFP     | 3    | -    | 255                | DOTCLK |
| Horizontal Address         | HACT    | -    | 320  | -                  | DOTCLK |
| Horizontal Frequency       |         | -    | -    | 33                 | KHz    |
| Vertical Synchronization   | V_Low   | 1    | -    | V_Low < VBP        | Line   |
| Vertical Back Porch        | VBP     | 2    | -    | V_Low+VBP+VFP < 32 | Line   |
| Vertical Front Porch       | VFP     | 2    | -    |                    | Line   |
| Vertical Address           | VACT    | -    | 480  | -                  | Line   |
| Vertical Frequency         |         | 60   | -    | 70                 | Hz     |
| DOTCLK cycle               |         | 100  | -    | 50                 | ns     |
| DOTCLK Frequency           |         | 10   | -    | 20                 | MHz    |

DPI Parameters Setting(BYPASS bit = 1)

| Parameters                 | Symbols | Min. | Typ. | Max.               | Units  |
|----------------------------|---------|------|------|--------------------|--------|
| Horizontal Synchronization | H_Low   | 3    | -    | H_Low < HBP        | DOTCLK |
| Horizontal Back Porch      | HBP     | 20   | -    | 192                | DOTCLK |
| Horizontal Front Porch     | HFP     | 70   | -    | 255                | DOTCLK |
| Horizontal Address         | HACT    | -    | 320  | -                  | DOTCLK |
| Horizontal Frequency       |         | -    | -    | 33                 | KHz    |
| Vertical Synchronization   | V_Low   | 1    | -    | V_Low < VBP        | Line   |
| Vertical Back Porch        | VBP     | 2    | -    | V_Low+VBP+VFP < 32 | Line   |
| Vertical Front Porch       | VFP     | 2    | -    |                    | Line   |
| Vertical Address           | VACT    | -    | 480  | -                  | Line   |
| Vertical Frequency         |         | 60   | -    | 70                 | Hz     |
| DOTCLK cycle               |         | 83.3 | -    | 50                 | ns     |
| DOTCLK Frequency           |         | 12   | -    | 20                 | MHz    |

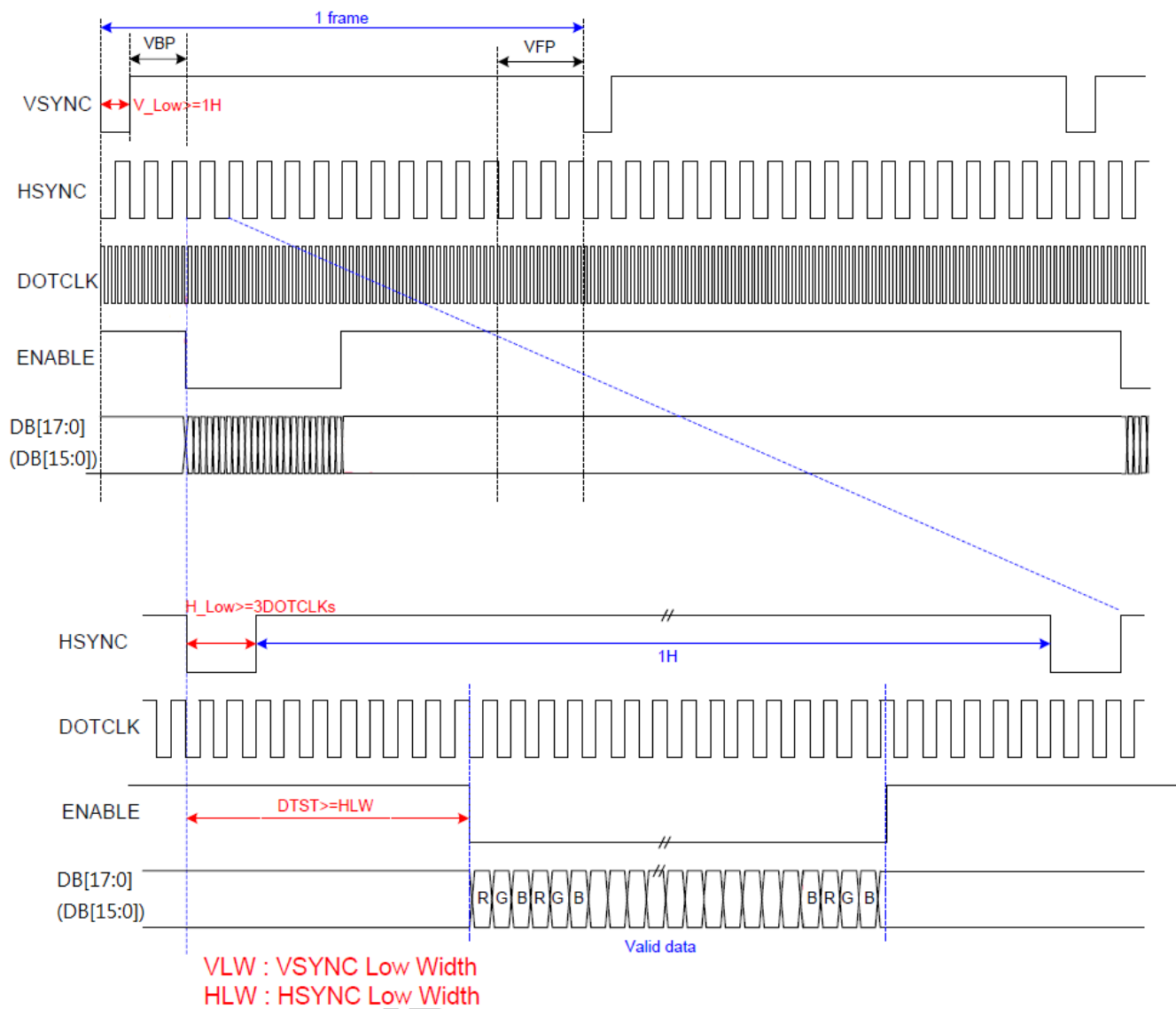


Figure 14: RGB Interface Timing Diagram

7.6. Other command, display data format..., Please reference the ILI9488 Spec



# 8. Optical Characteristics

| Item               | Symbol | Condition.                        | Min  | Typ. | Max. | Unit              | Remark            |            |
|--------------------|--------|-----------------------------------|------|------|------|-------------------|-------------------|------------|
| Response time      | Tr     | $\theta=0^\circ$ 、 $\phi=0^\circ$ | -    | 30   | -    | .ms               | Note 3            |            |
|                    | Tf     |                                   |      |      |      |                   |                   |            |
| Contrast ratio     | CR     | At optimized viewing angle        | -    | 700  | -    | -                 | Note 4            |            |
| Color Chromaticity | White  | $\theta=0^\circ$ 、 $\phi=0^\circ$ | 0.26 | 0.31 | 0.36 |                   | Note 2,6,7        |            |
|                    |        |                                   |      |      |      |                   |                   | Wy         |
| Viewing angle      | Hor.   | $CR \geq 10$                      | -    | 80   | -    | Deg.              | Note 1            |            |
|                    |        |                                   |      |      |      |                   |                   | $\Theta L$ |
|                    | Ver.   |                                   |      |      |      |                   |                   | $\Phi T$   |
|                    |        |                                   |      |      |      |                   |                   | $\Phi B$   |
| Brightness         | -      | -                                 | 500  | 600  | -    | cd/m <sup>2</sup> | Center of display |            |
| Uniformity         | (U)    | -                                 | 75   | -    | -    | %                 | Note5             |            |

Ta=25±2°C (ILED=160mA)

Note 1: Definition of viewing angle range

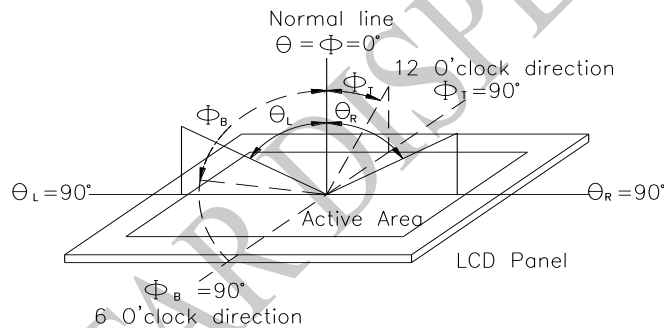


Fig 8.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

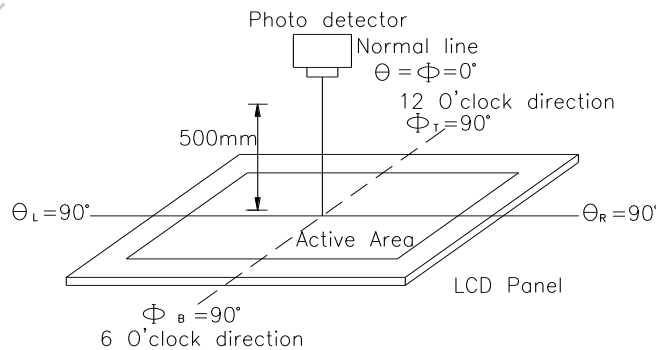
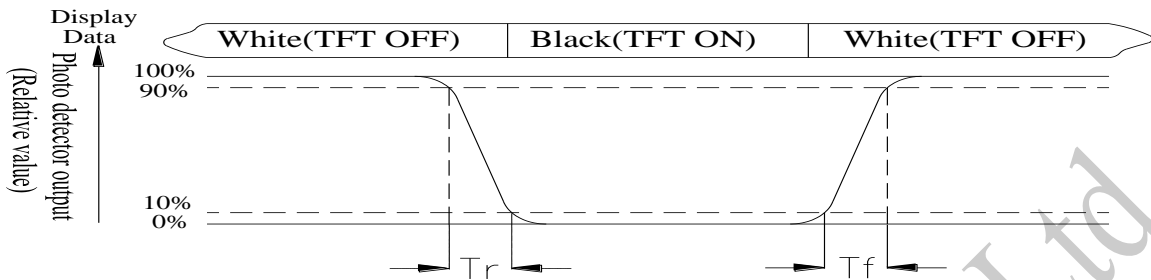


Fig 8.2. Optical measurement system setup

**Note 3: Definition of Response time:**

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time,  $T_r$ , is the time between photo detector output intensity changed from 90% to 10%. And fall time,  $T_f$ , is the time between photo detector output intensity changed from 10% to 90%



**Note 4: Definition of contrast ratio:**

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

**Note 5: Definition of Luminance Uniformity**

Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min}/L_{\max} \times 100\%$$

$L$  = Active area length

$W$  = Active area width

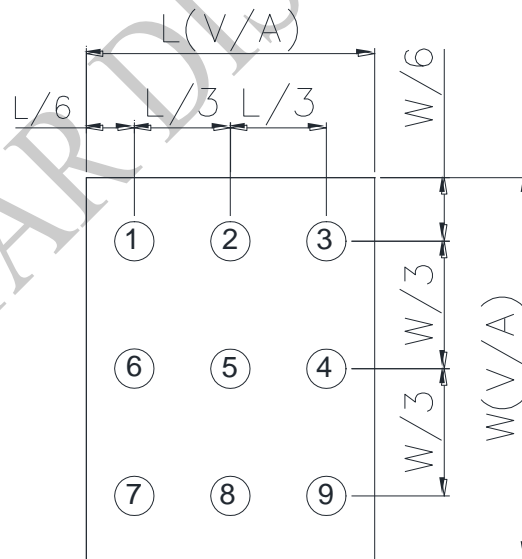


Fig 8.3. Definition of uniformity

**Note 6: Definition of color chromaticity (CIE 1931)**

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

# 9.Interface

## LCM PIN Definition

| NO    | Symbol   | Function  | I/O |
|-------|----------|---|-----|
| 1     | LEDK     | Cathode of LED backlight                            | P   |
| 2     | LEDA     | Anode of LED backlight.                             | P   |
| 3     | IM0      | Note 1  | I   |
| 4     | IM1      | Note 1  | I   |
| 5     | IM2      | Note 1  | I   |
| 6     | RESET    | System reset pin.                                   | I   |
| 7     | NC(VS)   | No Connection (Vrtical Sync signal) Note 2)         | I   |
| 8     | NC(HS)   | No Connection (Horizontal Sync signal ; Note 2)     | I   |
| 9     | NC(DCLK) | No Connection (Pixel clock signal; Note 2)          | I   |
| 10    | NC(DE)   | No Connection (Data Enable; Note 2)                 | I   |
| 11-16 | DB17-12  | Data bus (R5~R0; RGB-18bit Pixel; Note 2)           | I   |
| 17-22 | DB11-6   | Data bus (G5~G0; RGB-18bit Pixel; Note 2)           | I   |
| 23-28 | DB5-0    | Data bus (R5~G0; RGB-18bit Pixel; Note 2)           | I   |
| 29    | NC (SDA) | Connection (serial data input/output pin)           | I   |
| 30    | RD       | Read strobe signal. Read out data when RDX is Low.  | I   |
| 31    | WR (SCL) | Write data when WRX is Low.(serial clock input pin) | I   |
| 32    | D/C      | register select                                     | I   |
| 33    | CS (NCS) | Chip select signal (serial chip select input pin)   | I   |
| 34    | IOVCC    | Power supply (TYP:1.8V/2.8V).                       | P   |
| 35    | VCI      | Power supply(TYP:2.8V).                             | P   |
| 36    | GND      | Ground  | P   |
| 37    | NC       | No connection                                       |     |
| 38    | NC       | No connection                                       |     |
| 39    | NC       | No connection                                       |     |
| 40    | NC       | No connection                                       |     |

Note 1:

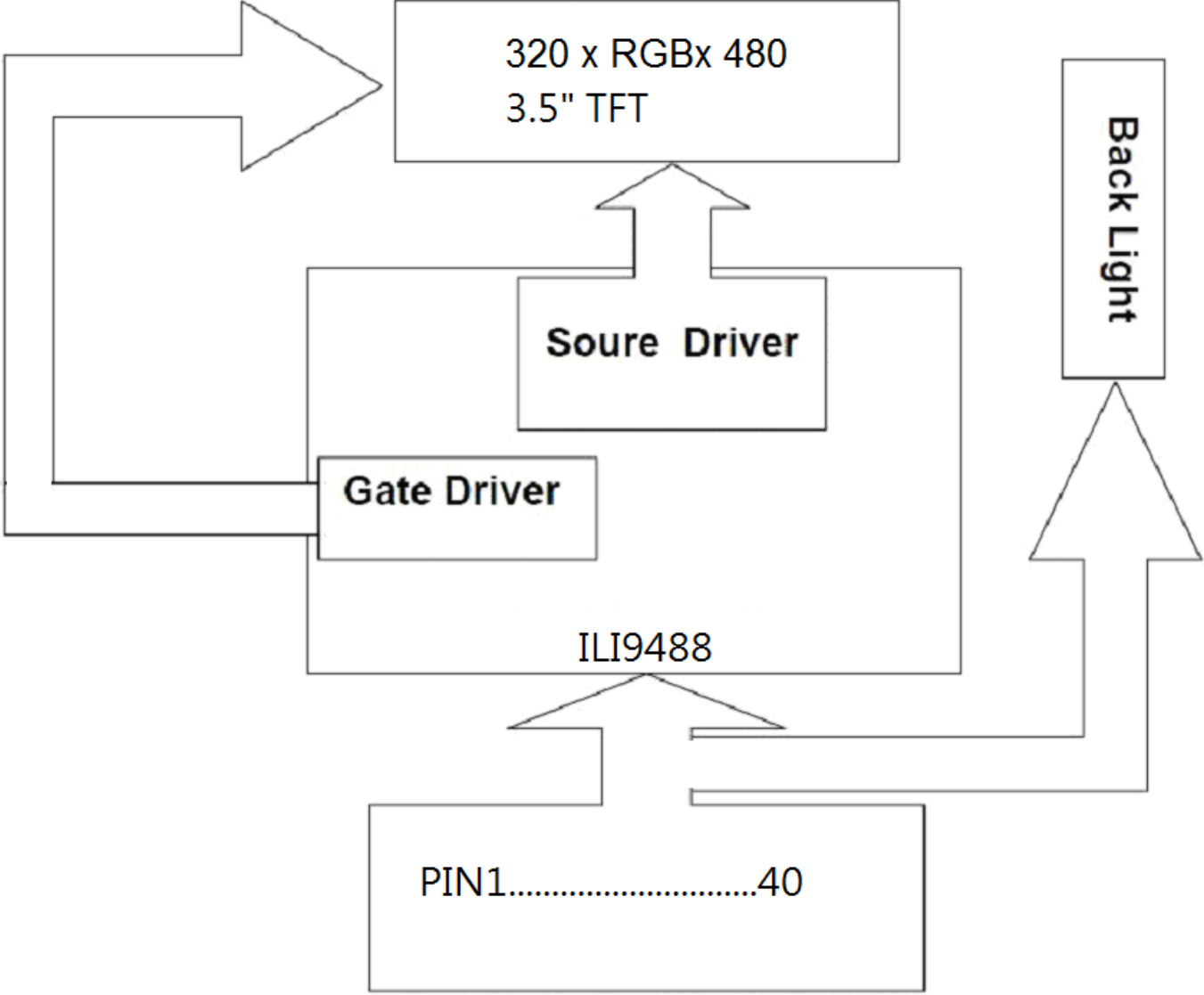
| IM2 | IM1 | IM0 | MPU Interface       | GRAM   |
|-----|-----|-----|---------------------|--|
| 0   | 0   | 0   | 8080 MCU 18-bit bus | D[17:0]  |
| 0   | 1   | 0   | 8080 MCU 16-bit bus | D[15:0]  |
| 0   | 1   | 1   | 8080 MCU 8-bit bus  | D[7:0]   |
| 1   | 0   | 1   | 3-Line SPI          | SDA,SCL,NCS  |
| 1   | 0   | 1   | RGB interface+3-SPI | D[17:0] (RGB-18bit/Pixel)<br>D[15:0] (RGB-16bit/Pixel) |

Note 2:

This module suggests function is for 8080 MCU mode, if this module wants change to use RGB Interface mode, please setting external pin IM [2:0] as 101 (3-SPI Initial code setting RGB-18bit/Pixel or RGB-16bit/Pixel),and reference the **7.5. RGB Interface Selection**

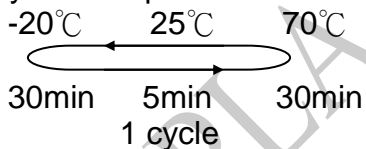
WINSTAR DISPLAY CO., LTD.

# 10. Block Diagram



# 11. Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

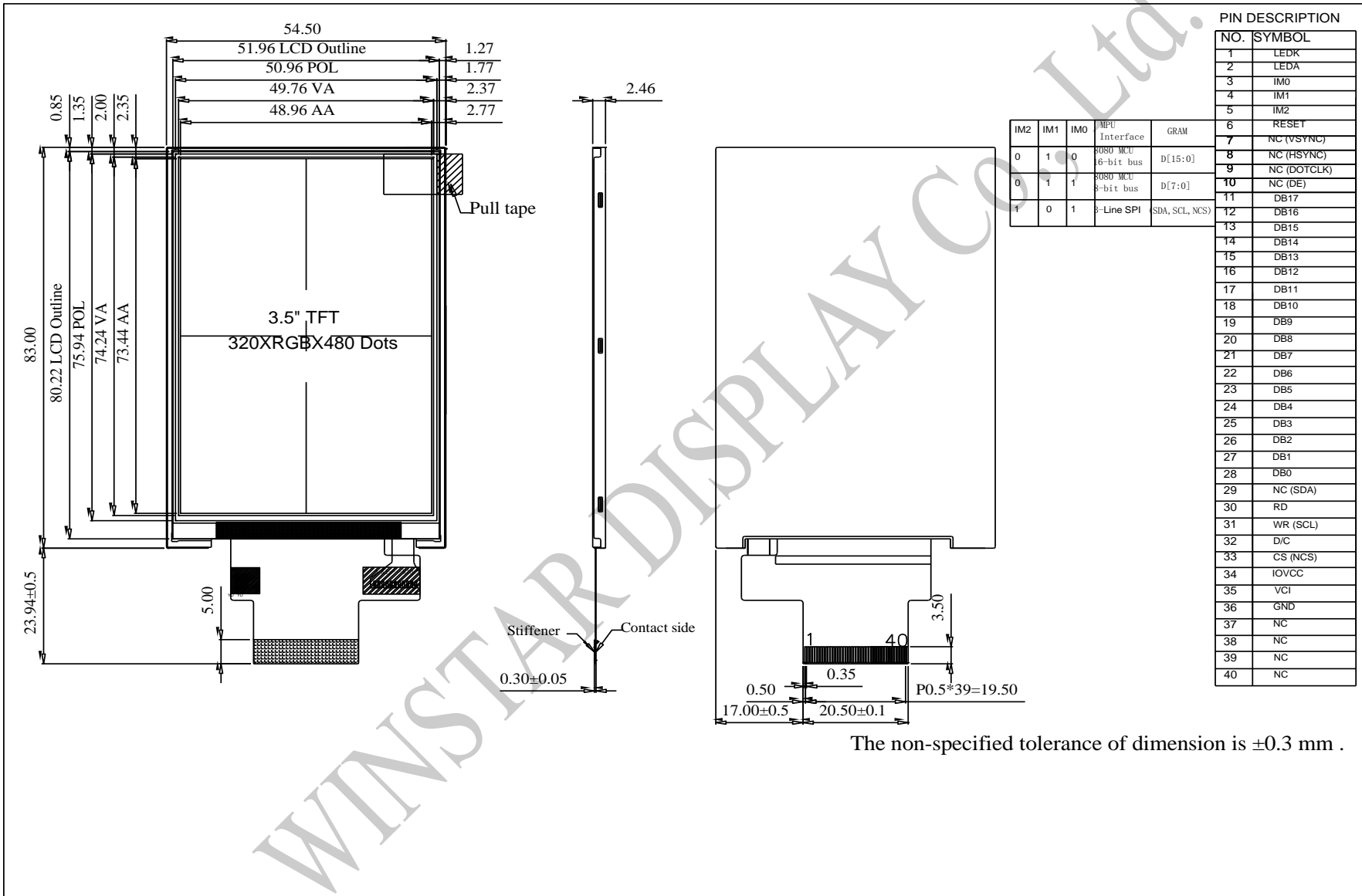
| Environmental Test                   |   |  |      |
|--------------------------------------|---|--|------|
| Test Item                            | Content of Test   | Test Condition   | Note |
| High Temperature storage             | Endurance test applying the high storage temperature for a long time.   | 80°C<br>96hrs  | 2    |
| Low Temperature storage              | Endurance test applying the low storage temperature for a long time.  | -30°C<br>96hrs   | 1,2  |
| High Temperature Operation           | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.  | 70°C<br>96hrs  | —    |
| Low Temperature Operation            | Endurance test applying the electric stress under low temperature for a long time.  | -20°C<br>96hrs   | 1    |
| High Temperature/ Humidity Operation | The module should be allowed to stand at 40°C,90%RH max   | 40°C,90%RH<br>96hrs  | 1,2  |
| Thermal shock resistance             | The sample should be allowed stand the following 10 cycles of operation<br> | -20°C/70°C<br>10 cycles  | —    |
| Vibration test                       | Endurance test applying the vibration during transportation and using.  | Total fixed amplitude : 1.5mm<br>Vibration<br>Frequency : 10~55Hz<br>One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes | 3    |
| Static electricity test              | Endurance test applying the electric stress to the terminal.  | VS=±600V(contact)<br>,±800v(air),<br>RS=330Ω<br>CS=150pF<br>10 times   | —    |

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

# 12. Contour Drawing





**1、Panel Specification :**

- 1. Panel Type :  Pass  NG , \_\_\_\_\_
- 2. View Direction :  Pass  NG , \_\_\_\_\_
- 3. Numbers of Dots :  Pass  NG , \_\_\_\_\_
- 4. View Area :  Pass  NG , \_\_\_\_\_
- 5. Active Area :  Pass  NG , \_\_\_\_\_
- 6. Operating :  Pass  NG , \_\_\_\_\_
- 7. Storage Temperature :  Pass  NG , \_\_\_\_\_
- 8. Others : \_\_\_\_\_

**2、Mechanical**

- 1. PCB Size :  Pass  NG , \_\_\_\_\_
- 2. Frame Size :  Pass  NG , \_\_\_\_\_
- 3. Material of Frame :  Pass  NG , \_\_\_\_\_
- 4. Connector Position :  Pass  NG , \_\_\_\_\_
- 5. Fix Hole Position :  Pass  NG , \_\_\_\_\_
- 6. Backlight Position :  Pass  NG , \_\_\_\_\_
- 7. Thickness of PCB :  Pass  NG , \_\_\_\_\_
- 8. Height of Frame to PCB :  Pass  NG , \_\_\_\_\_
- 9. Height of Module :  Pass  NG , \_\_\_\_\_
- 10. Others :  Pass  NG , \_\_\_\_\_

**3、Relative Hole Size :**

- 1. Pitch of Connector :  Pass  NG , \_\_\_\_\_
- 2. Hole size of Connector :  Pass  NG , \_\_\_\_\_
- 3. Mounting Hole size :  Pass  NG , \_\_\_\_\_
- 4. Mounting Hole Type :  Pass  NG , \_\_\_\_\_
- 5. Others :  Pass  NG , \_\_\_\_\_

**4、Backlight Specification :**

- 1. B/L Type :  Pass  NG , \_\_\_\_\_
- 2. B/L Color :  Pass  NG , \_\_\_\_\_
- 3. B/L Driving Voltage (Reference for LED) :  Pass  NG , \_\_\_\_\_
- 4. B/L Driving Current :  Pass  NG , \_\_\_\_\_
- 5. Brightness of B/L :  Pass  NG , \_\_\_\_\_
- 6. B/L Solder Method :  Pass  NG , \_\_\_\_\_
- 7. Others :  Pass  NG , \_\_\_\_\_





Winstar Module Number : \_\_\_\_\_

Page: 2

**5、Electronic Characteristics of Module :**

- 1. Input Voltage :                     Pass                     NG , \_\_\_\_\_
- 2. Supply Current :                     Pass                     NG , \_\_\_\_\_
- 3. Driving Voltage for LCD :         Pass                     NG , \_\_\_\_\_
- 4. Contrast for LCD :                     Pass                     NG , \_\_\_\_\_
- 5. B/L Driving Method :                 Pass                     NG , \_\_\_\_\_
- 6. Negative Voltage Output :         Pass                     NG , \_\_\_\_\_
- 7. Interface Function :                 Pass                     NG , \_\_\_\_\_
- 8. LCD Uniformity :                     Pass                     NG , \_\_\_\_\_
- 9. ESD test :                             Pass                     NG , \_\_\_\_\_
- 10. Others :                               Pass                     NG , \_\_\_\_\_

**6、Summary :**

Sales signature : \_\_\_\_\_

Customer Signature : \_\_\_\_\_

Date :        /        /        \_\_\_\_\_

