# TFT DISPLAY SPECIFICATION




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

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**Winstar Display Co., LTD**
**華凌光電股份有限公司**

# SPECIFICATION

**CUSTOMER :** _____

**MODULE NO.:** WF20-240320BD#0P3-FC

| | |
|---|---|
| **APPROVED BY:**<br>**( FOR CUSTOMER USE ONLY )** | **PCB VERSION:** **DATA:** |

| SALES BY | APPROVED BY | CHECKED BY | PREPARED BY |
|---|---|---|---|
| | | | 葉虹蘭 |
| **ISSUED DATE:** 2022/12/20 | | | |

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|---|---|
| **RECORDS OF REVISION** | **DOC. FIRST ISSUE** |

| VERSION | DATE | REVISED PAGE NO. | **SUMMARY** |
|---|---|---|---|
| 0 | 2022/12/20 | | First issue |

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# Summary

TFT 2.0”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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# General Specifications

| Item | Dimension | Unit |
|---|---|---|
| Size | 2.0” | inch |
| Dot Matrix | 240 x RGB x 320(TFT) | dots |
| Module dimension | 38.4(W) x 51.9(H) x3.98(D) | mm |
| Active area | 30.60 x 40.80 | mm |
| Pixel Pitch | 0.1275 x 0.1275 | mm |
| LCD type | TFT, Normally Black, Transmissive | |
| TFT Interface | MCU / SPI | |
| TFT Driver IC | ST7789VI or Equivalent | |
| Viewing angle | 80/80/80/80 | |
| Aspect Ratio | 3：4 | |
| Backlight Type | LED,Normally White | |
| CTP Driver IC | GT911 or equivalent | |
| CTP Interface | I2C | |
| CTP FW | 92 | |
| CTP Resolution | 240 * 320 | |
| With /Without TP | With CTP | |
| Surface | Glare | |

*Color tone slight changed by temperature and driving voltage.

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# Absolute Maximum Ratings

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

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

1. Temp. ≦60℃, 90% RH MAX. Temp.＞60℃, Absolute humidity shall be less than 90% RH at 60℃

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# Electrical Characteristics

**Operating conditions**

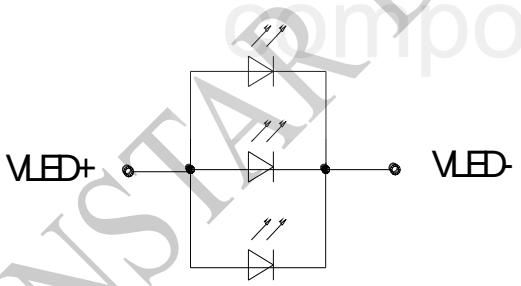
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage For Analog | $V_{DD}$ | — | 2.4 | 3.3 | 3.6 | V |
| Interface Operation Voltage | $V_{DDI}$ | — | 1.65 | 1.8 | 3.6 | V |
| Supply Current For LCM | $I_{DD}$ | $V_{DD} = V_{DDI}$ = $V_{CC}$=3.0V | — | 6.0 | 9.0 | mA |
| Supply CTP | $V_{CTP}$ | — | 2.8 | — | 3.3 | V |
| | $I_{CTP}$ | — | — | 8.0 | 12.0 | mA |

Note: to avoid power supply noise, please avoid using driving conditions close to min, or max value

**5.2. LED driving conditions**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| LED current | — | — | 60 | — | mA | — |
| LED voltage | VLED+ | 2.7 | 3.1 | 3.4 | V | Note 1 |
| LED Life Time | — | — | 50,000 | — | Hr | Note 2,3,4 |

Note 1 : There are 1 Groups LED




Back Light Circuit

Note 2 : Ta = 25 ℃

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

Note 4 : The single LED lamp case

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# Optical Characteristics

| Item | | Symbol | Condition. | Min | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Response time | | Tr+ Tf | θ=0°、Φ=0° | - | 35 | 45 | ms | Note 3 |
| Contrast ratio | | CR | At optimized viewing angle | 640 | 800 | - | - | Note 4 |
| Color Chromaticity | White | Wx | θ=0°、Φ=0 | 0.246 | 0.296 | 0.346 | | Note 2,6,7 |
| | | Wy | | 0.275 | 0.325 | 0.375 | | |
| Viewing angle (Gray Scale Inversion Direction) | Hor. | ΘR | CR≧ 10 | - | 80 | - | Deg. | Note 1 |
| | | ΘL | | - | 80 | - | | |
| | Ver. | ΦT | | - | 80 | - | | |
| | | ΦB | | - | 80 | - | | |
| Brightness | | - | - | 400 | 450 | - | cd/m² | Center of display |
| Uniformity | | (U) | - | 75 | - | - | % | Note5 |

Ta=25±2℃

Note 1: Definition of viewing angle range

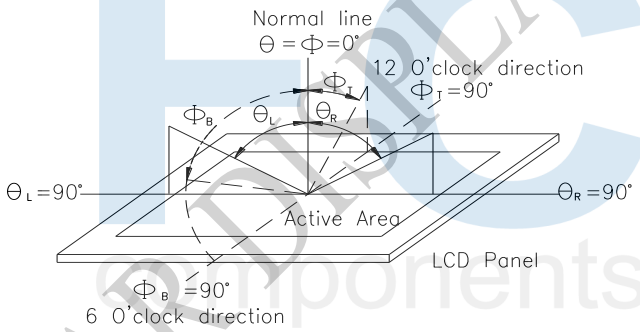



Fig. 8.1. Definition of viewing angle

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-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

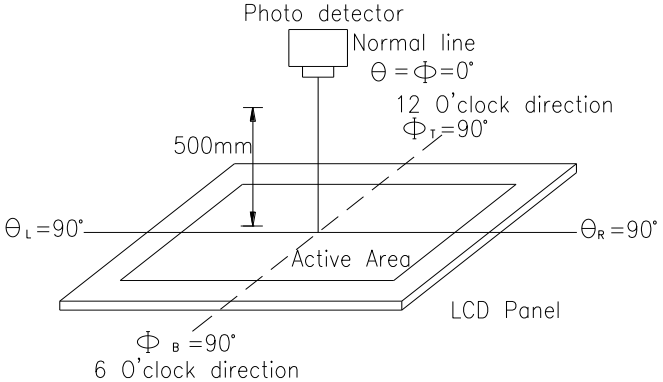



Fig. 8.2. Optical measurement system setup

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# Interface

**LCM PIN Definition**

| NO | Symbol | Function |
|---|---|---|
| 1 | GND | Ground |
| 2 | NC(YU) | No connection |
| 3 | NC(XL) | No connection |
| 4 | NC(YD) | No connection |
| 5 | NC(XR) | No connection |
| 6 | NC | No connection |
| 7 | VDD | Power supply |
| 8 | VDDI | Power Supply for I/O System. |
| 9 | TE | Tearing effect signal is used to synchronize MCU to frame memory writing.<br>If not used, please let this pin open |
| 10 | CSX | Chip selection pin<br>Low enable.<br>High disable. |
| 11 | DCX(SCL) | (D/CX): This pin is used to select “Data or Command” in the parallel interface.<br>DCX=’1’: display data or parameter.<br>DCX=’0’: command data.<br>(SCL): When SPI mode,This pin is used to be serial interface clock. |
| 12 | WRX(D/CX) | Display data/command selection<br>Second Data lane in 2 data lane serial interface.<br>(WRX): Write enable in MCU parallel interface.<br>(D/CX): When 4-SPI mode,This pin in 4-line serial interface<br>If not used, please fix this pin at VDDI or GND. |
| 13 | RDX | -Read enable in 8080 MCU parallel interface.<br>-If not used, please fix this pin at VDDI or GND. |
| 14~29 | DB0~DB15 | Data bus line |
| 30 | RESX | System reset pin.<br>signal is active low |
| 31 | IM0 | The MCU interface mode select. |
| 32 | IM1 | |
| 33 | IM2 | |

| IM2 | IM1 | IM0 | MPU Interface Mode | Data pin |
|---|---|---|---|---|
| 0 | 0 | 0 | 80-8bit parallel I/F | DB[7:0] |
| 0 | 0 | 1 | 80-16bit parallel I/F | DB[15:0] |
| 0 | 1 | 0 | 80-9bit parallel I/F | DB[8:0] |
| 0 | 1 | 1 | 80-18bit parallel I/F | DB[17:0], |
| 1 | 0 | 1 | 3-line 9bit serial I/F | SDA: in/out |
| 1 | 1 | 0 | 4-line 8bit serial I/F | SDA: in/out |

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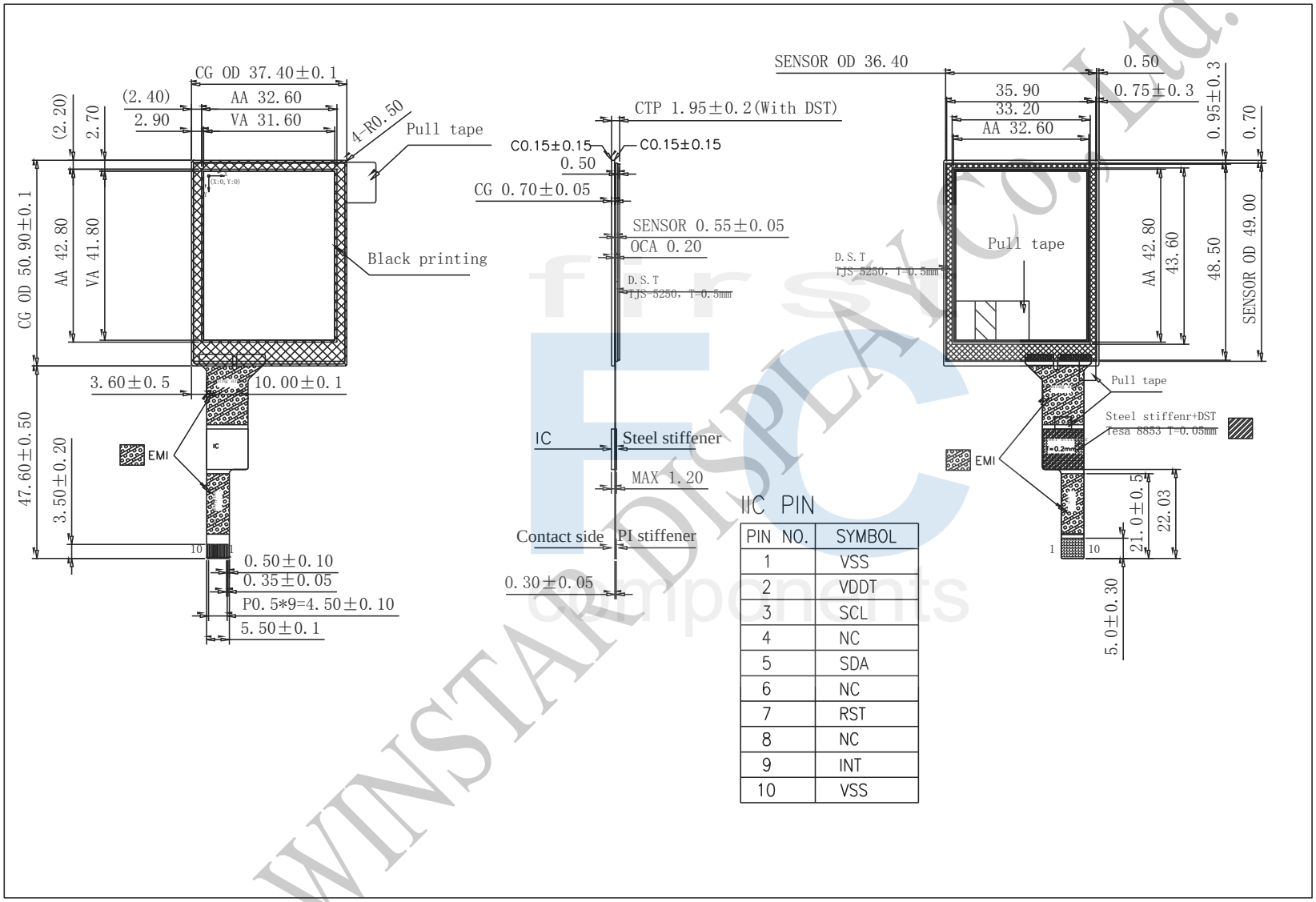
| | | |
|---|---|---|
| 34~35 | DB16~DB17 | Data bus line |
| 36 | VLED- | Cathode of LED backlight. |
| 37 | VLED- | Cathode of LED backlight. |
| 38 | VLED+ | Anode of LED backlight. |
| 39 | NC(SDA) | When SPI mode, This pin is SPI interface input/output pin.<br>The data is latched on the rising edge of the SCL signal.<br>If not used(NC), please fix this pin at VDDI or GND level. |
| 40 | NC | No connection |

**CTP PIN Definition**

| Pin | Symbol | Function | Remark |
|---|---|---|---|
| 1 | VSS | Ground for analog circuit | |
| 2 | VDDT | Power Supply : | |
| 3 | SCL | I2C clock inputI2C clock input | |
| 4 | NC | No connect | |
| 5 | SDA | I2C data input and output | |
| 6 | NC | No connect | |
| 7 | /RST | External Reset, Low is active | |
| 8 | NC | No connect | |
| 9 | /INT | External interrupt to the host | |
| 10 | VSS | Ground for analog circuit | |

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# Touch Panel Information

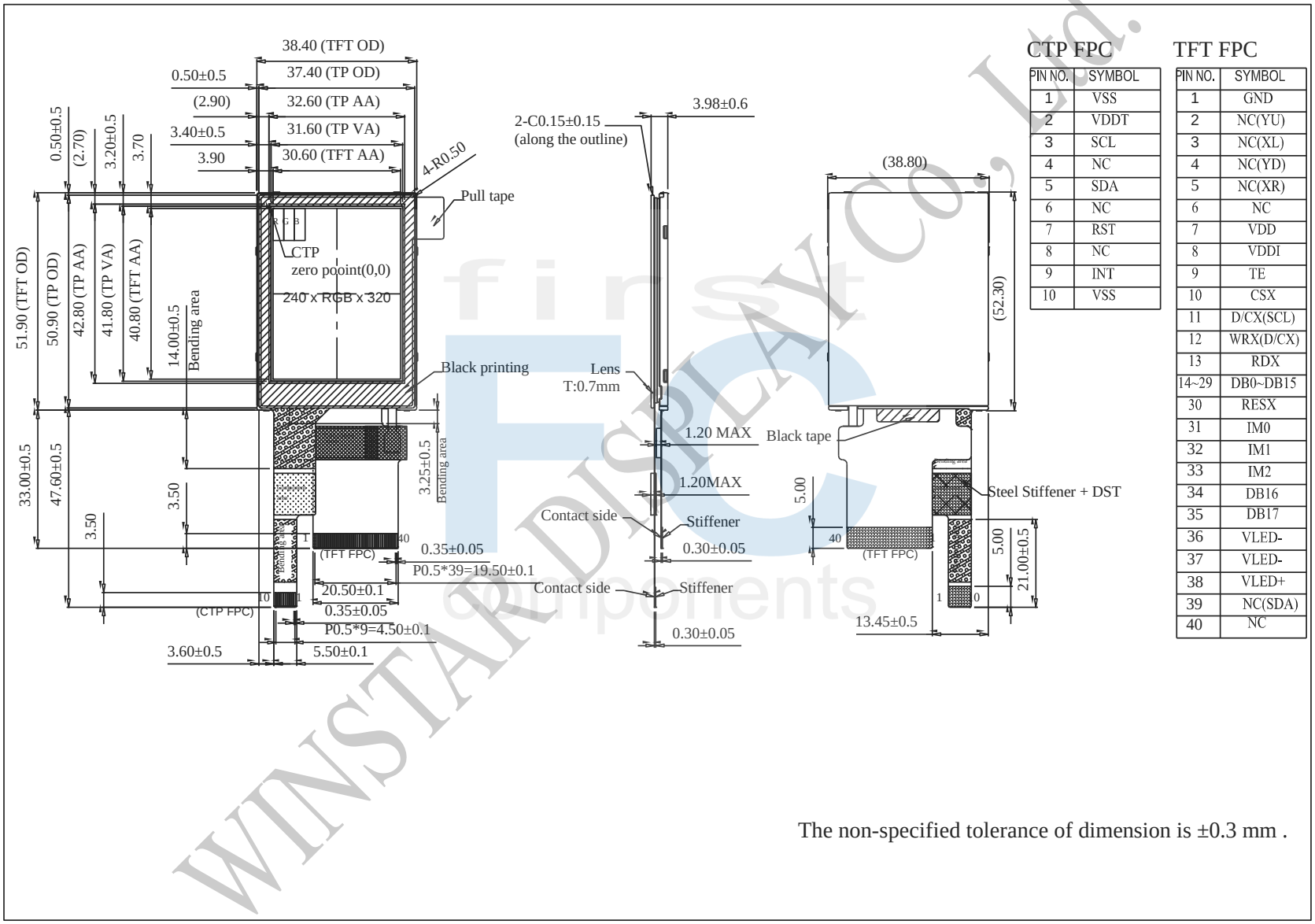



IIC PIN

| PIN NO. | SYMBOL |
|---|---|
| 1 | VSS |
| 2 | VDDT |
| 3 | SCL |
| 4 | NC |
| 5 | SDA |
| 6 | NC |
| 7 | RST |
| 8 | NC |
| 9 | INT |
| 10 | VSS |

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# Contour Drawing




CTP FPC

| PIN NO. | SYMBOL |
|---|---|
| 1 | VSS |
| 2 | VDDT |
| 3 | SCL |
| 4 | NC |
| 5 | SDA |
| 6 | NC |
| 7 | RST |
| 8 | NC |
| 9 | INT |
| 10 | VSS |

TFT FPC

| PIN NO. | SYMBOL |
|---|---|
| 1 | GND |
| 2 | NC(YU) |
| 3 | NC(XL) |
| 4 | NC(YD) |
| 5 | NC(XR) |
| 6 | NC |
| 7 | VDD |
| 8 | VDDI |
| 9 | TE |
| 10 | CSX |
| 11 | D/CX(SCL) |
| 12 | WRX(D/CX) |
| 13 | RDX |
| 14~29 | DB0~DB15 |
| 30 | RESX |
| 31 | IM0 |
| 32 | IM1 |
| 33 | IM2 |
| 34 | DB16 |
| 35 | DB17 |
| 36 | VLED- |
| 37 | VLED- |
| 38 | VLED+ |
| 39 | NC(SDA) |
| 40 | NC |

The non-specified tolerance of dimension is ±0.3 mm .

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# Initial Code For Reference

```
void ST7789SV_WF0200B(void) for SPI & MCU mode
{
      Write_Command(0x11);    //Sleep out
      delay(150);                //Delay 120ms

   Write_Command(0x36);       //
   Write_Data(0x00);

      Write_Command(0x3A);   //
   Write_Data(0x55);

      //ST7789S Frame rate setting
      Write_Command(0xb2);    //Porch Setting
      Write_Data(0x0c);
      Write_Data(0x0c);
      Write_Data(0x00);
      Write_Data(0x33);
      Write_Data(0x33);
      Write_Command(0xb7);    //Gate Control
      //Write_Data(0x35);       //vgh vgl
      Write_Data(0x64);

      //ST7789S Power setting
      Write_Command(0xbb);    //Gate Control  VCOMS=1.425V
      Write_Data(0x30);
      Write_Command(0xc0);    //LCM Control
      Write_Data(0x2c);
      Write_Command(0xc2);    //VDV and VRH Command Enable
      Write_Data(0x01);
      Write_Command(0xc3);    //VRH Set (AVDD=VRH+1.675
      Write_Data(0x0b);
      Write_Command(0xc4);    //VRH Set
      Write_Data(0x20);
      Write_Command(0xc6);    //Frame Rate Control in Normal Mode
      Write_Data(0x0f);
      Write_Command(0xca);    //Register Value Selection 2
      Write_Data(0x0f);
      Write_Command(0xc8);    //Register Value Selection 1
      Write_Data(0x08);
      Write_Command(0x55);    //Write Content Adaptive Brightness Control and Color Enhancement
      Write_Data(0x90);
      Write_Command(0xd0);    //Power Control
      Write_Data(0xa4);
      Write_Data(0xa1);
      Write_Command(0x35);    //

      Write_Command(0x26);    //Set Gamma
      Write_Data(0x02);

      //ST7789S gamma setting
```

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```
    Write_Command(0xe0);
    Write_Data(0xd0);
    Write_Data(0x00);
    Write_Data(0x02);
    Write_Data(0x07);
    Write_Data(0x0b);
    Write_Data(0x1a);
    Write_Data(0x31);
    Write_Data(0x54);
    Write_Data(0x40);
    Write_Data(0x29);
    Write_Data(0x12);
    Write_Data(0x12);
    Write_Data(0x12);
    Write_Data(0x17);
    Write_Command(0xe1);
    Write_Data(0xd0);
    Write_Data(0x00);
    Write_Data(0x02);
    Write_Data(0x07);
    Write_Data(0x05);
    Write_Data(0x25);
    Write_Data(0x2d);
    Write_Data(0x44);
    Write_Data(0x45);
    Write_Data(0x1c);
    Write_Data(0x18);
    Write_Data(0x16);
    Write_Data(0x1c);
    Write_Data(0x1d);

  Write_Command(0x21);

    Write_Command(0x2A);
    Write_Data(0x00);
    Write_Data(0x00);
    Write_Data(0x00);
    Write_Data(0xEF);

    Write_Command(0x2B);
    Write_Data(0x00);
    Write_Data(0x0);
    Write_Data(0x01);
    Write_Data(0x3F);

    Write_Command(0x29);

}
```

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