

## Product Specification

|                    |                                                  |
|--------------------|--------------------------------------------------|
| <b>Model Name</b>  | S024HQ42NN-DC05                                  |
| <b>Description</b> | TFT LCD Module<br>2.4" QVGA<br>240(RGB)x320 Dots |
| <b>Date</b>        | 2019/6/18                                        |
| <b>Version</b>     | 1.0                                              |

|                             |                          |                             |
|-----------------------------|--------------------------|-----------------------------|
| <b>Approved<br/>by/Date</b> | <b>Check<br/>by/Date</b> | <b>Prepared<br/>by/Date</b> |
| ZHP 2019/06/18              | Zhaoxia.Hu 2019/6/18     | Yigui.Han 2019/06/18        |

| Customer Approval |  |
|-------------------|--|
|                   |  |
| <b>Date</b>       |  |



# CDTech(H.K.)Electronics Limited

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## 1. Record of Revision

| Rev | Issued Date | Description    | Editor    |
|-----|-------------|----------------|-----------|
| 1.0 | 2019/6/18   | First Release. | Yigui.Han |
|     |             |                |           |
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## 2. General Specifications

| Feature         |                      | Spec                                                      |
|-----------------|----------------------|-----------------------------------------------------------|
| Characteristics | Size                 | 2.4 inch                                                  |
|                 | Resolution           | 240(horizontal)*320(Vertical)                             |
|                 | Interface            | MCU-18/16/9/8 Bit<br>RGB-18/16/6 Bit<br>SPI 3-Line&4-Line |
|                 | Connect type         | Connector                                                 |
|                 | Display Colors       | 65K/262K                                                  |
|                 | Technology type      | a-Si                                                      |
|                 | Pixel pitch (mm)     | 0.153*0.153                                               |
|                 | Pixel Configuration  | R.G.B.-Stripe                                             |
|                 | Display Mode         | Normally Black                                            |
|                 | Driver IC            | ILI9340X                                                  |
|                 | CTP Driver IC        | GT911                                                     |
|                 | Viewing Direction    | Full view                                                 |
| Mechanical      | LCM (W x H x D) (mm) | 42.72*60.26*4.00                                          |
|                 | Active Area(mm)      | 36.72*48.96                                               |
|                 | With /Without TSP    | With CTP                                                  |
|                 | Weight (g)           | TBD                                                       |
|                 | LED Numbers          | 4 LEDs                                                    |

Note 1: Requirements on Environmental Protection: RoHs

Note 2: LCM weight tolerance: +/- 5%

## 3. Input/Output Terminals

### LCD PIN-MAP

| PIN NO. | PIN NAME  | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
|---------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------|---------------------|------------------|--------------------------------|--------|------------------|---|---|---|---|-------------------------------|----------|----------|---|---|---|---|--------------------------------|--------|---------|---|---|---|---|-------------------------------|----------|---------|---|---|---|---|---------------------------------------|---------------------|--|---|---|---|---|---------------------------------------|---------------------|--|
| 1       | VCI       | Power supply.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 2       | IOVCC     | Digital power supply.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 3       | IM0       | <table><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>80 MCU 16-bit bus interface II</td><td>D[8:1]</td><td>D[17:10], D[8:1]</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>80 MCU 8-bit bus interface II</td><td>D[17:10]</td><td>D[17:10]</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>80 MCU 18-bit bus interface II</td><td>D[8:1]</td><td>D[17:0]</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>80 MCU 9-bit bus interface II</td><td>D[17:10]</td><td>D[17:9]</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>3-wire 9-bit data serial interface II</td><td colspan="2">SDI: In<br/>SDO: Out</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>4-wire 8-bit data serial interface II</td><td colspan="2">SDI: In<br/>SDO: Out</td></tr></table> | 1 | 0                                     | 0                   | 0                | 80 MCU 16-bit bus interface II | D[8:1] | D[17:10], D[8:1] | 1 | 0 | 0 | 1 | 80 MCU 8-bit bus interface II | D[17:10] | D[17:10] | 1 | 0 | 1 | 0 | 80 MCU 18-bit bus interface II | D[8:1] | D[17:0] | 1 | 0 | 1 | 1 | 80 MCU 9-bit bus interface II | D[17:10] | D[17:9] | 1 | 1 | 0 | 1 | 3-wire 9-bit data serial interface II | SDI: In<br>SDO: Out |  | 1 | 1 | 1 | 0 | 4-wire 8-bit data serial interface II | SDI: In<br>SDO: Out |  |
| 1       | 0         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 | 80 MCU 16-bit bus interface II        | D[8:1]              | D[17:10], D[8:1] |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 1       | 0         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 | 80 MCU 8-bit bus interface II         | D[17:10]            | D[17:10]         |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 1       | 0         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 | 80 MCU 18-bit bus interface II        | D[8:1]              | D[17:0]          |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 1       | 0         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 | 80 MCU 9-bit bus interface II         | D[17:10]            | D[17:9]          |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 1       | 1         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 | 3-wire 9-bit data serial interface II | SDI: In<br>SDO: Out |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 1       | 1         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0 | 4-wire 8-bit data serial interface II | SDI: In<br>SDO: Out |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 4       | IM3       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 5       | IM2       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 6       | IM1       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 7       | RESET     | Reset signal input terminal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 8       | VSYNC     | Vertical Sync signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 9       | HSYNC     | Horizontal Sync signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 10      | DOTCLK    | Dot clock signal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 11      | ENABLE    | Data Enable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 12~29   | DB17~DB0  | DATA BUS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 30      | SDO       | Serial output data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 31      | SDI       | Serial Input Data.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 32      | RD        | Read signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 33      | WR/(D/CX) | 8080-I system :Write signal<br>Serial interface: Data or command select.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 34      | RS/(SCL)  | 8081-I system :Data or command select.<br>Serial interface:Serial clock signal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 35      | CS        | Chip select                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 36      | GND       | System Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 37      | LEDA      | LED Anode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 38      | LEDK      | LED Cathode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 39      | LEDK      | LED Cathode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 40      | NC        | No connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 41      | NC        | No connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 42      | NC        | No connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 43      | NC        | No connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 44      | NC        | No connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |
| 45      | NC        | No connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                       |                     |                  |                                |        |                  |   |   |   |   |                               |          |          |   |   |   |   |                                |        |         |   |   |   |   |                               |          |         |   |   |   |   |                                       |                     |  |   |   |   |   |                                       |                     |  |

## CTP PIN-MAP

| Pin | Signal     | Description                   |
|-----|------------|-------------------------------|
| 1   | GND        | Ground                        |
| 2   | SCL (2.8V) | I2C clock input               |
| 3   | SDA (2.8V) | I2C data input and output     |
| 4   | INT (2.8V) | Interrupt request to the host |
| 5   | RESET      | Reset Pin for CTP             |
| 6   | VCC        | Power supply for CTP          |

## 4. Absolute Maximum Rating

### Driving TFT LCD Panel

| Item                  | Symbol           | MIN  | MAX | Unit | Remark |
|-----------------------|------------------|------|-----|------|--------|
| Supply Voltage        | V <sub>CC</sub>  | 2.5  | 4.8 | V    |        |
| Input Voltage         | IOVCC            | 1.65 | 3.3 | V    |        |
| Operating Temperature | T <sub>OPR</sub> | -20  | 70  | °C   |        |
| Storage Temperature   | T <sub>STG</sub> | -30  | 80  | °C   |        |

## 5. Timing characteristics

### 5.1 ELECTRICAL CHARACTERISTICS

| Item                               |            | Symbol            | MIN             | TYP | MAX        | Unit | Remark |
|------------------------------------|------------|-------------------|-----------------|-----|------------|------|--------|
| Analog Supply Voltage              |            | V <sub>CC</sub>   | 2.5             | 2.8 | 3.3        | V    |        |
| Logic Signal Input /Output Voltage |            | IOVCC             | 1.65            | 1.8 | 3.3        | V    |        |
| Input Signal Voltage               | Low Level  | V <sub>IL</sub>   | V <sub>SS</sub> | -   | 0.3x IOVCC | V    |        |
|                                    | High Level | V <sub>IH</sub>   | 0.7x IOVCC      | -   | IOVCC      | V    |        |
| TFT Common Electrode               |            | V <sub>COMH</sub> | 2.5             | -   | 5          | V    |        |
| TFT Gate ON Voltage                |            | V <sub>GH</sub>   | 10              | -   | 16         | V    |        |
| TFT Gate ON Voltage                |            | V <sub>GL</sub>   | -10             | -   | -5         | V    |        |

## 5.2 CTP Electrical Characteristics

| FPC Design | Item                    | Description     | Remark |
|------------|-------------------------|-----------------|--------|
| COF        | IC solution on TP Model | GT911           |        |
|            | Touch Count Max         | 5 point         |        |
|            | Display Resolution      | 240*320         |        |
|            | Interface Type          | I2C             |        |
|            | I2C Slave Address       | -               |        |
|            | Origin of Coordinate    | Top left corner |        |

## 5.3 LED Driving Conditions

| Item            | Symbol | MIN | TYP   | MAX  | Unit | Remark |
|-----------------|--------|-----|-------|------|------|--------|
| Forward Current | $I_F$  | -   | 20    | -    | mA   |        |
| Forward Voltage | $V_F$  | 9.0 | 12.0  | 10.2 | V    |        |
| LED Lifetime    |        | -   | 30000 | -    | Hrs  |        |

Note 1: Each LED:  $I_F = 20 \text{ mA}$ ,  $V_F = 3.2 \pm 0.2 \text{ V}$ .

Note 2: Optical performance should be evaluated at  $T_a = 25^\circ \text{C}$  only.

Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

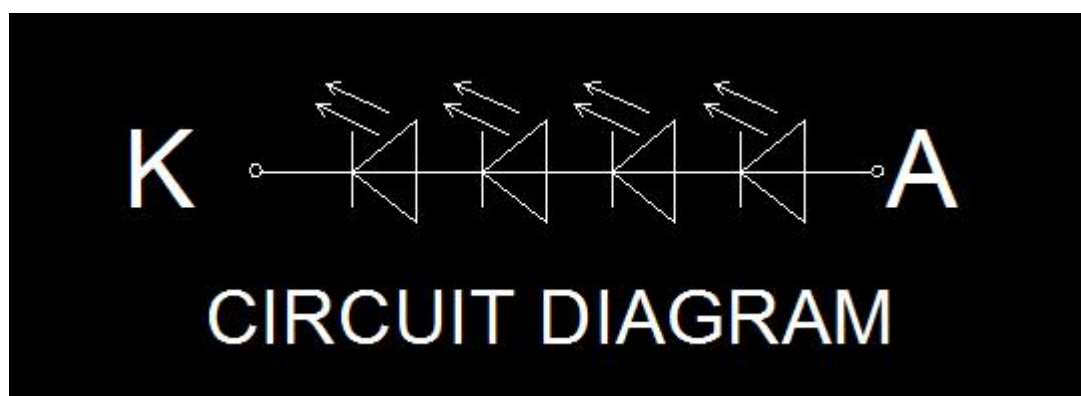
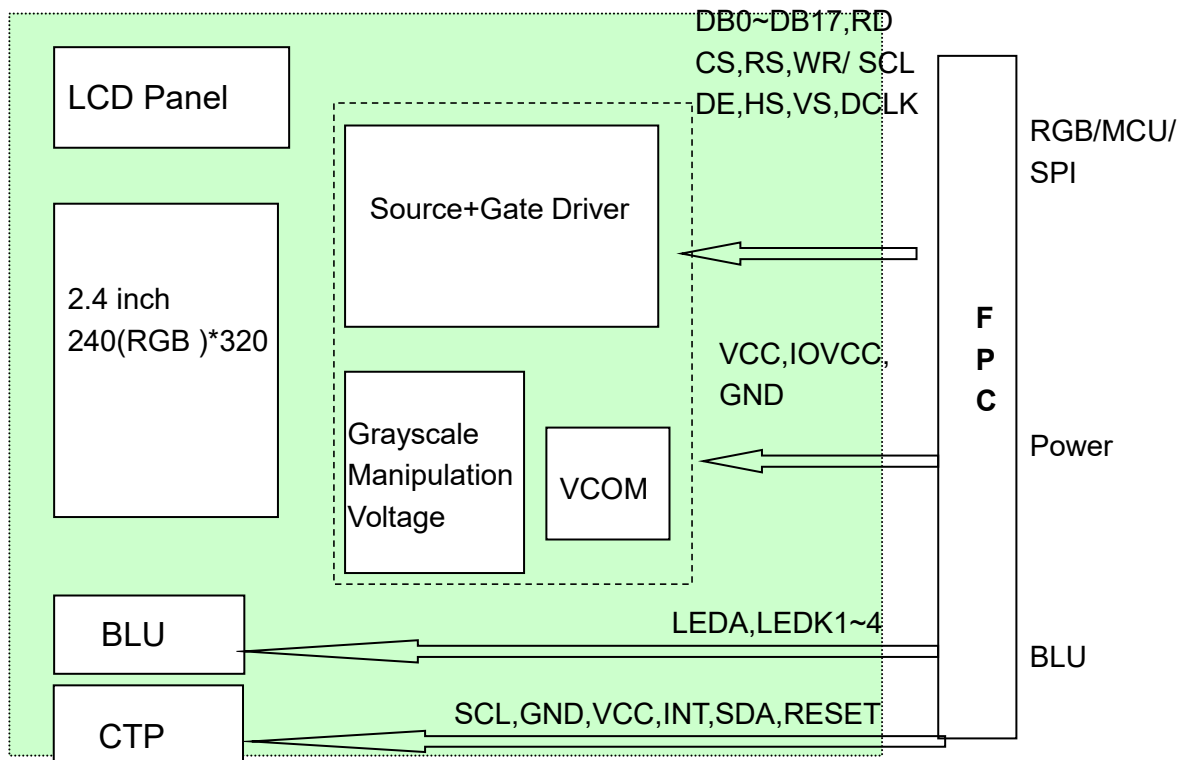


Figure: LED connection of backlight(Constant Current)

## 5.4 Block Diagram



## 6. Interface Timing

### 6.1 DC Electrical Characteristics

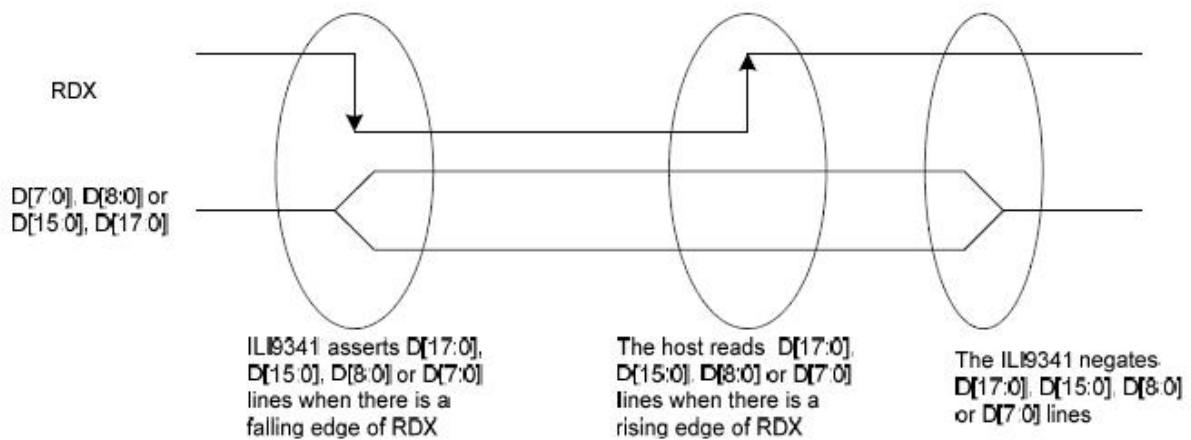
| Symbol                           | Parameter                                          | Test Condition                                                                     | Min                              | Typ | Max       | Unit    |
|----------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------|-----|-----------|---------|
| VDDIO                            | Power supply pin of IO pins                        | Recommend Operating Voltage<br>Possible Operating Voltage                          | 1.4                              | -   | 3.3       | V       |
| VCI                              | Booster Reference Supply Voltage Range             | Recommend Operating Voltage<br>Possible Operating Voltage                          | 2.5 or VDDIO whichever is higher | -   | 3.3       | V       |
| VGH                              | Gate driver High Output Voltage Booster efficiency | No panel loading; 4x or 5x booster; ITO for CYP, CYN, VCIX2, VCI and VCHS = 10 Ohm | 88                               | 90  | -         | %       |
|                                  |                                                    | No panel loading; 6x booster; ITO for CYP, CYN, VCIX2, VCI and VCHS = 10 Ohm       | 82                               | 84  | -         | %       |
| VCIX2                            | VCIX2 primary booster efficiency                   | No panel loading, ITO for CYP, CYN, VCIX2, VCI and VCHS = 10 Ohm                   | 83                               | 85  | -         | %       |
| VGH                              | Gate driver High Output Voltage                    |                                                                                    | 9                                | -   | 18        | V       |
| VGL                              | Gate driver Low Output Voltage                     |                                                                                    | -15                              | -   | -6        | V       |
| VcomH                            | Vcom High Output Voltage                           |                                                                                    | $V_{CI} + 0.5$                   | -   | 5         | V       |
| VcomL                            | Vcom Low Output Voltage                            |                                                                                    | $-V_{CIM} + 0.5$                 | -   | -1        | V       |
| VLCD63                           | Max. Source Voltage                                |                                                                                    | -                                | -   | 6         | V       |
| $\Delta VLCD63$                  | Source voltage variation                           |                                                                                    | -2                               |     | 2         | %       |
| V <sub>OH1</sub>                 | Logic High Output Voltage                          | I <sub>out</sub> = -100 $\mu$ A                                                    | 0.9*VDDIO                        | -   | VDDIO     | V       |
| V <sub>OL1</sub>                 | Logic Low Output Voltage                           | I <sub>out</sub> = 100 $\mu$ A                                                     | 0                                | -   | 0.1*VDDIO | V       |
| V <sub>IH1</sub>                 | Logic High Input voltage                           |                                                                                    | 0.8*VDDIO                        | -   | VDDIO     | V       |
| V <sub>IL1</sub>                 | Logic Low Input voltage                            |                                                                                    | 0                                | -   | 0.2*VDDIO | V       |
| I <sub>OH</sub>                  | Logic High Output Current Source                   | V <sub>out</sub> = V <sub>DDIO</sub> - 0.4V                                        | 50                               | -   | -         | $\mu$ A |
| I <sub>OL</sub>                  | Logic Low Output Current Drain                     | V <sub>out</sub> = 0.4V                                                            | -                                | -   | -50       | $\mu$ A |
| I <sub>oz</sub>                  | Logic Output Tri-state Current Drain Source        |                                                                                    | -1                               | -   | 1         | $\mu$ A |
| I <sub>IL</sub> /I <sub>IH</sub> | Logic Input Current                                |                                                                                    | -1                               | -   | 1         | $\mu$ A |

|                           |                                  |                                                                                                                               |                  |     |     |             |
|---------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------|-----|-----|-------------|
| C <sub>IN</sub>           | Logic Pins Input Capacitance     |                                                                                                                               | -                | 5   | 7.5 | pF          |
| R <sub>SON</sub>          | Source drivers output resistance |                                                                                                                               | -                | 1   | -   | k $\Omega$  |
| R <sub>GON</sub>          | Gate drivers output resistance   |                                                                                                                               | -                | 5   | -   | k $\Omega$  |
| R <sub>CON</sub>          | Vcom output resistance           |                                                                                                                               | -                | 200 | -   | $\Omega$    |
| I <sub>dp</sub> (262k)    | Display current for 262k         | V <sub>ddio</sub> = 1.8V, V <sub>ci</sub> = 2.8V, 5x/-5x booster ratio. Full color current consumption, without panel loading | I <sub>vdd</sub> | -   | 150 | 300 $\mu$ A |
|                           |                                  |                                                                                                                               | I <sub>vci</sub> | -   | 2.5 | 8 mA        |
| I <sub>dp</sub> (8 color) | Display current for 8 color mode | Current consumption for 8 color partial display, without panel loading                                                        | I <sub>vdd</sub> | -   | 120 | 300 $\mu$ A |
|                           |                                  |                                                                                                                               | I <sub>vci</sub> | -   | 1   | 5 mA        |
| I <sub>slp</sub>          | Sleep mode current               | Oscillator off, no source/gate output, Ram read write halt. Send command R10-0001 (sleep mode)                                | I <sub>vdd</sub> | -   | 0.5 | 1 $\mu$ A   |
|                           |                                  |                                                                                                                               | I <sub>vci</sub> | -   | 10  | 75 $\mu$ A  |

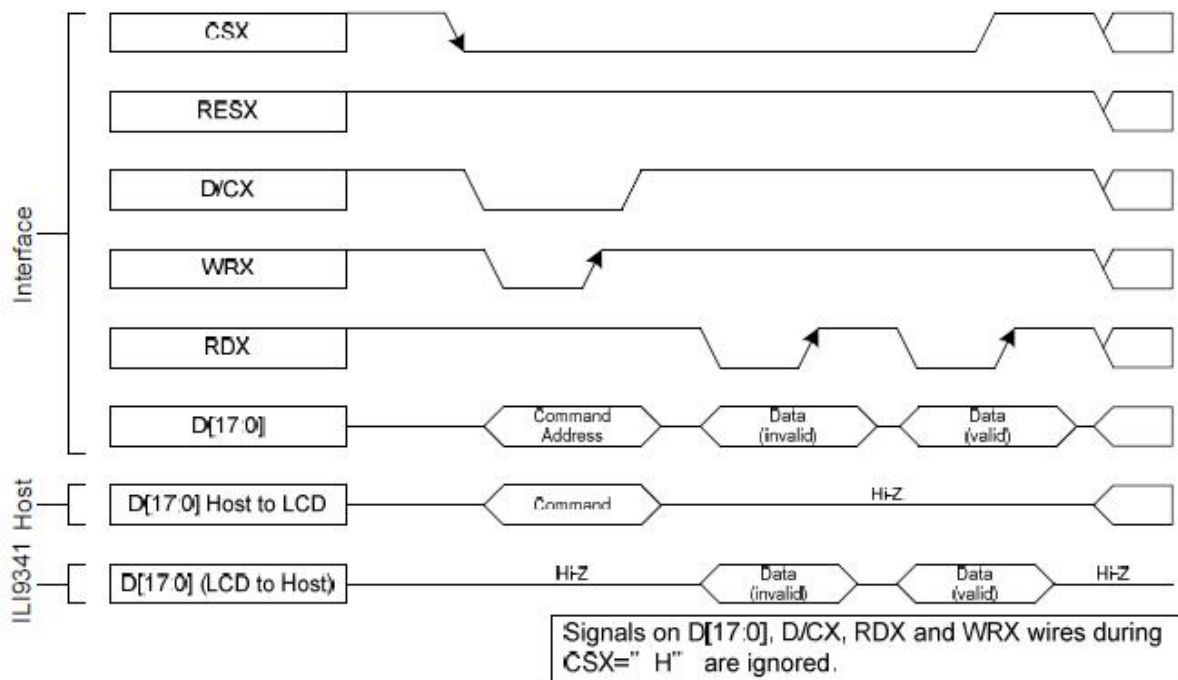
Remark: I<sub>vdd</sub> = I<sub>vddio</sub>

Note: The DC characteristic is base on only N-buffer or only P-buffer mode. (Refer to R3Fh command)

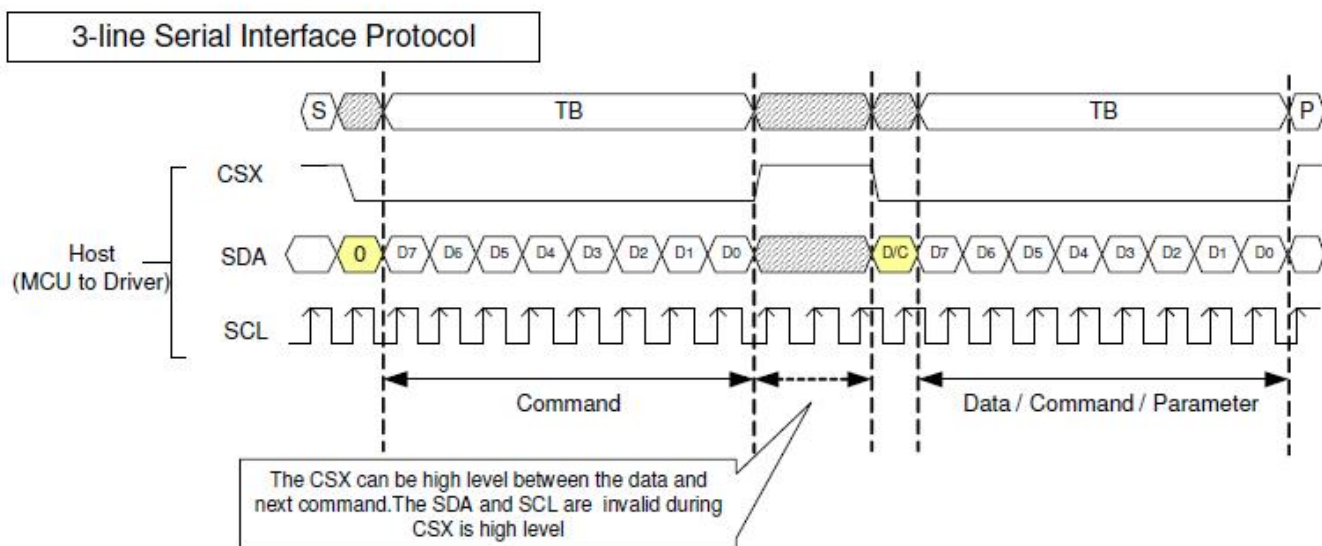
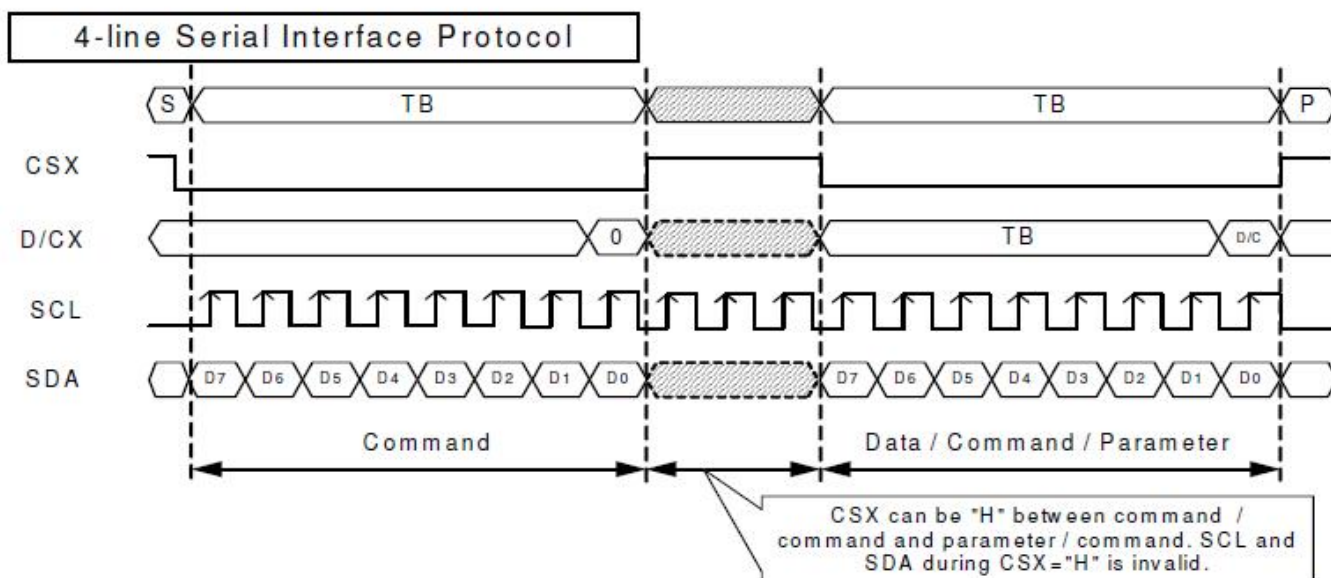
## 6.2 Timing

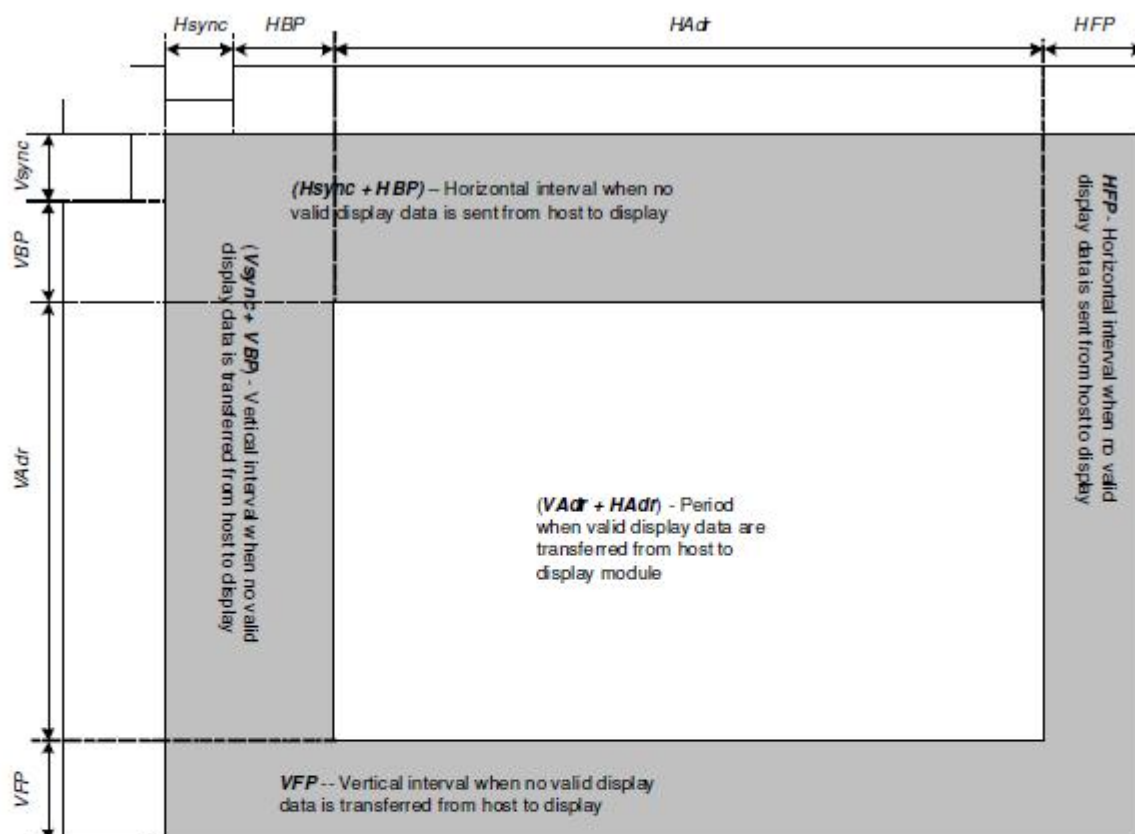


Note: RDX is an unsynchronized signal (It can be stopped).



Host processor drives the CSX pin to low and starts by setting the D/CX bit on SDA. The bit is read by ILI9341 on the first rising edge of SCL signal. On the next falling edge of SCL, the MSB data bit (D7) is set on SDA by the host. On the next falling edge of SCL, the next bit (D6) is set on SDA. If the optional D/CX signal is used, a byte is eight read cycle width. The 3/4-line serial interface writes sequence described in the figure as below.

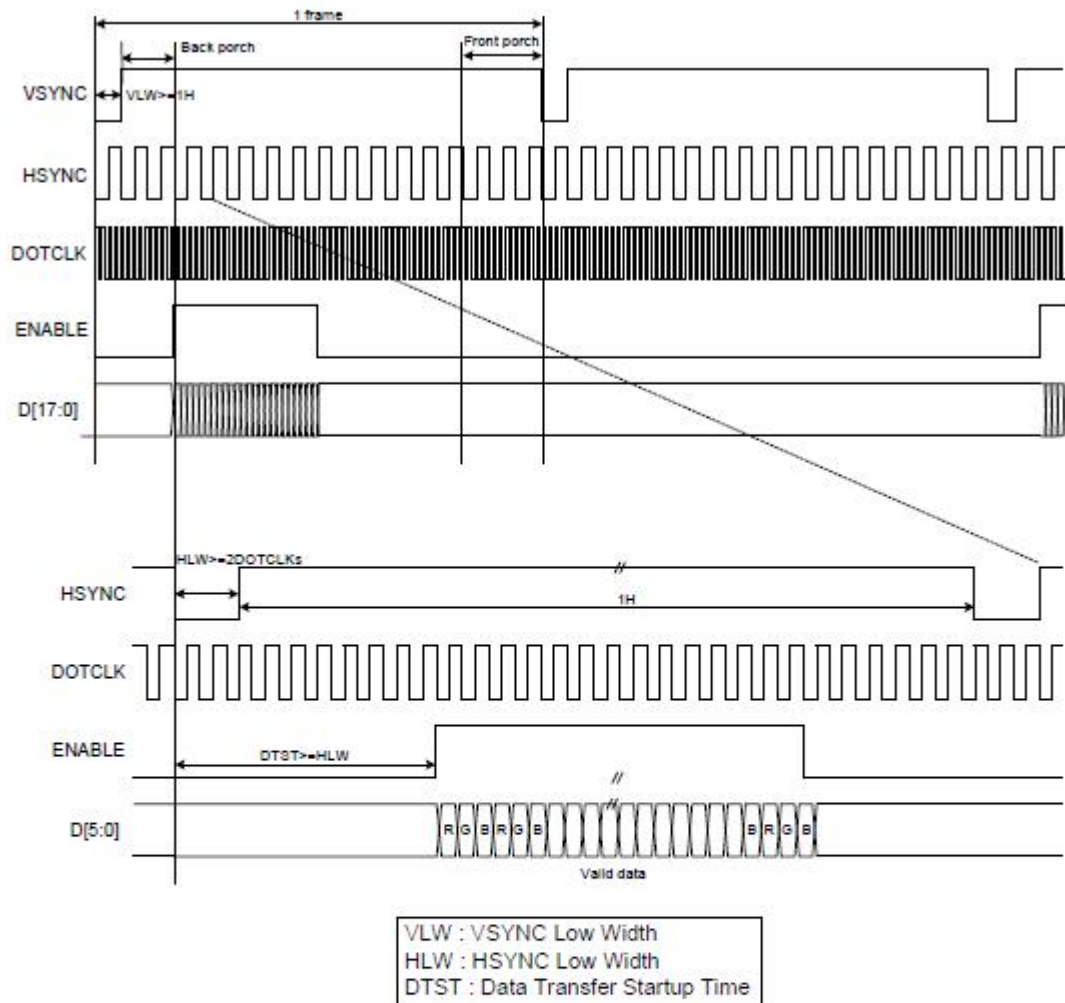
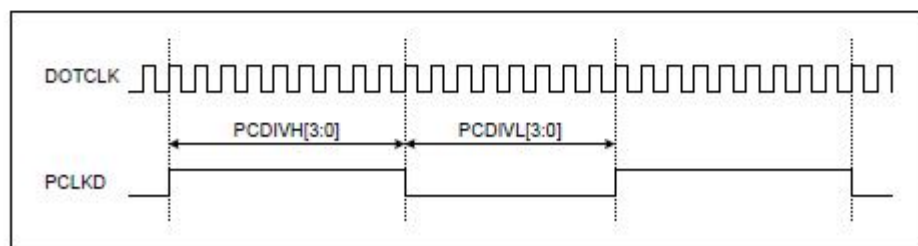




| Parameters                 | Symbols | Condition | Min. | Typ. | Max. | Units  |
|----------------------------|---------|-----------|------|------|------|--------|
| Horizontal Synchronization | Hsync   |           | 2    | 10   | 16   | DOTCLK |
| Horizontal Back Porch      | HBP     |           | 2    | 20   | 24   | DOTCLK |
| Horizontal Address         | HAdr    |           | -    | 240  | -    | DOTCLK |
| Horizontal Front Porch     | HFP     |           | 2    | 10   | 16   | DOTCLK |
| Vertical Synchronization   | Vsync   |           | 1    | 2    | 4    | Line   |
| Vertical Back Porch        | VBP     |           | 1    | 2    | -    | Line   |
| Vertical Address           | VAdr    |           | -    | 320  | -    | Line   |
| Vertical Front Porch       | VFP     |           | 3    | 4    | -    | Line   |

## 7.2.2. RGB interface timing

The timing chart of 18-/16-bit RGB interface mode is shown as below.

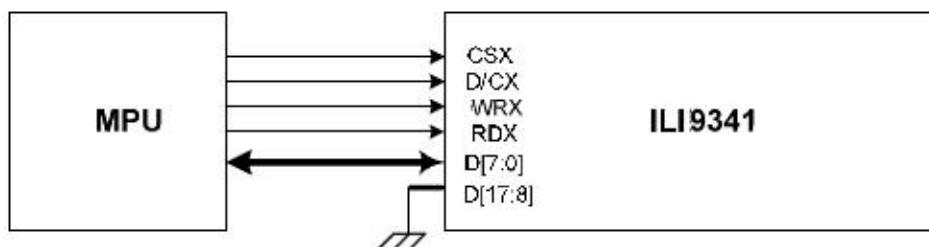


Note 1: The DE signal is not needed when RGB interface SYNC mode is selected.

Note 2: VSPL='0', HSPL='0', DPL='0' and EPL='0' of "Interface Mode Control (B0h)" command.

## 7.6.3. 8-bit Parallel MCU Interface

The 8080-1 system 8-bit parallel bus interface of ILI9341 can be used by setting external pin as IM [3:0] to "0000". The following shown figure is the example of interface with 8080-1 MCU system interface.



Different display data formats are available for two color depths supported by listed below.

- 65K-Colors, RGB 5, 6, 5 -bits input data.
- 262K-Colors, RGB 6, 6, 6 -bits input data.

### 65K color: 16-bit/pixel (RGB 5-6-5 bits input)

One pixel (3 sub-pixels) display data is sent by 2 byte transfers when DBI [2:0] bits of 3Ah register are set to "101".

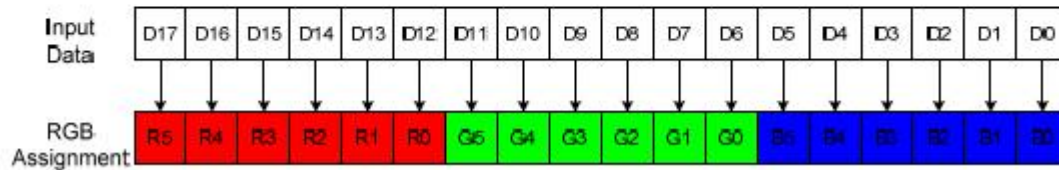
| Count | 0  | 1   | 2   | 3   | 4   | ... | 477   | 478   | 479   | 480   |
|-------|----|-----|-----|-----|-----|-----|-------|-------|-------|-------|
| D/CX  | 0  | 1   | 1   | 1   | 1   | ... | 1     | 1     | 1     | 1     |
| D7    | C7 | 0R4 | 0G2 | 1R4 | 1G2 | ... | 238R4 | 238G2 | 239R4 | 239G2 |
| D6    | C6 | 0R3 | 0G1 | 1R3 | 1G1 | ... | 238R3 | 238G1 | 239R3 | 239G1 |
| D5    | C5 | 0R2 | 0G0 | 1R2 | 1G0 | ... | 238R2 | 238G0 | 239R2 | 239G0 |
| D4    | C4 | 0R1 | 0B4 | 1R1 | 1B4 | ... | 238R1 | 238B4 | 239R1 | 239B4 |
| D3    | C3 | 0R0 | 0B3 | 1R0 | 1B3 | ... | 238R0 | 238B3 | 239R0 | 239B3 |
| D2    | C2 | 0G5 | 0B2 | 1G5 | 1B2 | ... | 238G5 | 238B2 | 239G5 | 239B2 |
| D1    | C1 | 0G4 | 0B1 | 1G4 | 1B1 | ... | 238G4 | 238B1 | 239G4 | 239B1 |
| D0    | C0 | 0G3 | 0B0 | 1G3 | 1B0 | ... | 238G3 | 238B0 | 239G3 | 239B0 |

### 65K color: 16-bit/pixel (RGB 5-6-5 bits input)

One pixel (3 sub-pixels) display data is sent by 1 transfer when DBI [2:0] bits of 3Ah register are set to "101".

| Count | 0  | 1   | 2   | 3   | ... | 238   | 239   | 240   |
|-------|----|-----|-----|-----|-----|-------|-------|-------|
| D/CX  | 0  | 1   | 1   | 1   | ... | 1     | 1     | 1     |
| D15   |    | 0R4 | 1R4 | 2R4 | ... | 237R4 | 238R4 | 239R4 |
| D14   |    | 0R3 | 1R3 | 2R3 | ... | 237R3 | 238R3 | 239R3 |
| D13   |    | 0R2 | 1R2 | 2R2 | ... | 237R2 | 238R2 | 239R2 |
| D12   |    | 0R1 | 1R1 | 2R1 | ... | 237R1 | 238R1 | 239R1 |
| D11   |    | 0R0 | 1R0 | 2R0 | ... | 237R0 | 238R0 | 239R0 |
| D10   |    | 0G5 | 1G5 | 2G5 | ... | 237G5 | 238G5 | 239G5 |
| D9    |    | 0G4 | 1G4 | 2G4 | ... | 237G4 | 238G4 | 239G4 |
| D8    |    | 0G3 | 1G3 | 2G3 | ... | 237G3 | 238G3 | 239G3 |
| D7    | C7 | 0G2 | 1G2 | 2G2 | ... | 237G2 | 238G2 | 239G2 |
| D6    | C6 | 0G1 | 1G1 | 2G1 | ... | 237G1 | 238G1 | 239G1 |
| D5    | C5 | 0G0 | 1G0 | 2G0 | ... | 237G0 | 238G0 | 239G0 |
| D4    | C4 | 0B4 | 1B4 | 2B4 | ... | 237B4 | 238B4 | 239B4 |
| D3    | C3 | 0B3 | 1B3 | 2B3 | ... | 237B3 | 238B3 | 239B3 |
| D2    | C2 | 0B2 | 1B2 | 2B2 | ... | 237B2 | 238B2 | 239B2 |
| D1    | C1 | 0B1 | 1B1 | 2B1 | ... | 237B1 | 238B1 | 239B1 |
| D0    | C0 | 0B0 | 1B0 | 2B0 | ... | 237B0 | 238B0 | 239B0 |

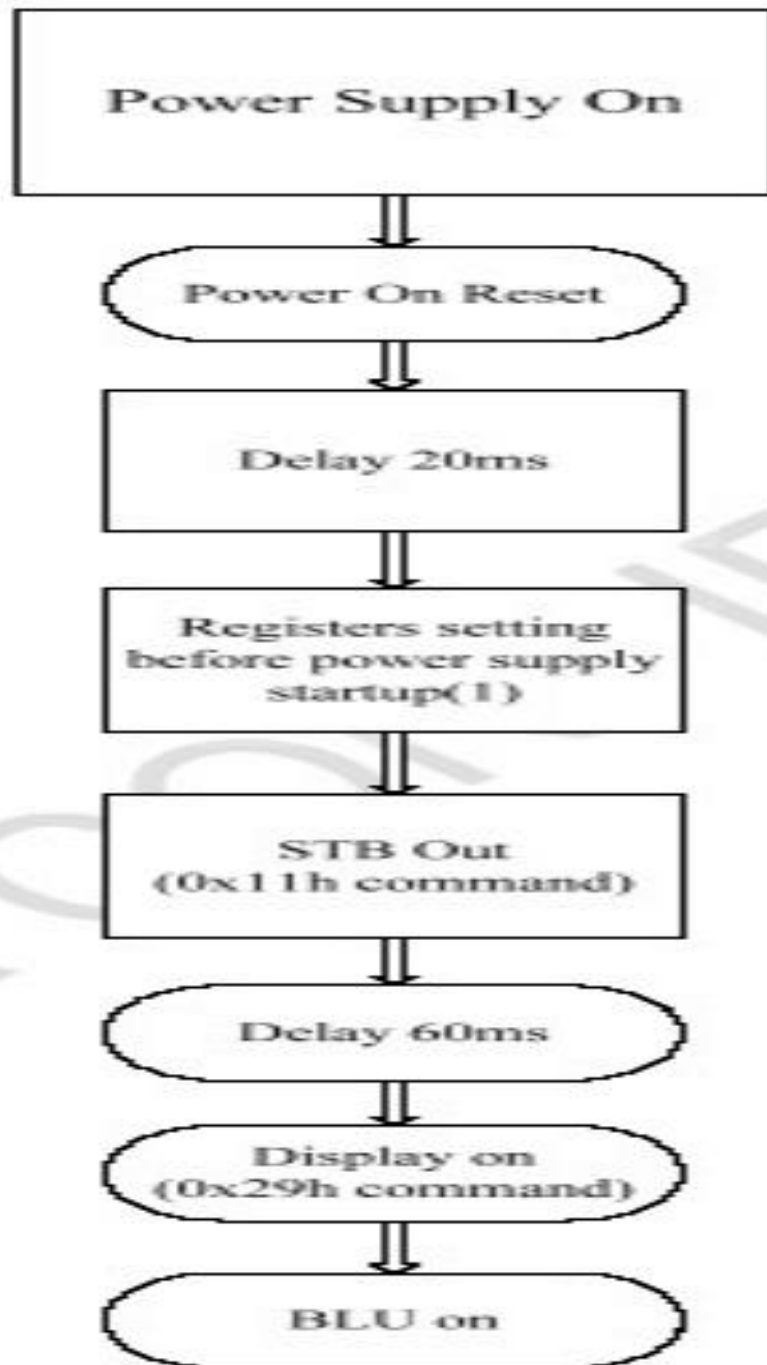
The 18-bit RGB interface is selected by setting the DPI [2:0] bits to "110". When RCM [1:0] are set to "10" and DE mode is selected, the display operation is synchronized with VSYNC, HSYNC and DOTCLK signals. The display data are transferred to the internal GRAM in synchronization with the display operation via 18-bit RGB data bus (D [17:0]) according to the data enable signal (DE) when RCM [1:0] are set to "10". The RGB interface SYNC mode is selected by setting the RCM [1:0] to "11", the valid display data is inputted in pixel unit via D [17:0] according to the VFP/VBP and HFP/HBP settings. Registers can be set by the SPI system interface.



The 16-bit RGB interface is selected by setting the DPI [2:0] bits to "101". When RCM [1:0] are set to "10" and DE mode is selected, the display operation is synchronized with VSYNC, HSYNC and DOTCLK signals. The display data is transferred to the internal GRAM in synchronization with the display operation via 16-bit RGB data bus (D [17:13] & D [11:1]) according to the data enable signal (DE). The RGB interface SYNC mode is selected by setting the RCM [1:0] to "11", the valid display data is inputted in pixel unit via D [17:13] and D [11:1] according to the VFP/VBP and HFP/HBP settings. The unused D12 and D0 pins must be connected to GND for ensure normally operation. Registers can be set by the SPI system interface.



## 6.3 Power ON/OFF Sequence



## 6.4 Capacitive touch panel Specification

### I2C

The I2C is always configured in the Slave mode. The data transfer format is shown in [Figure 2-4](#).

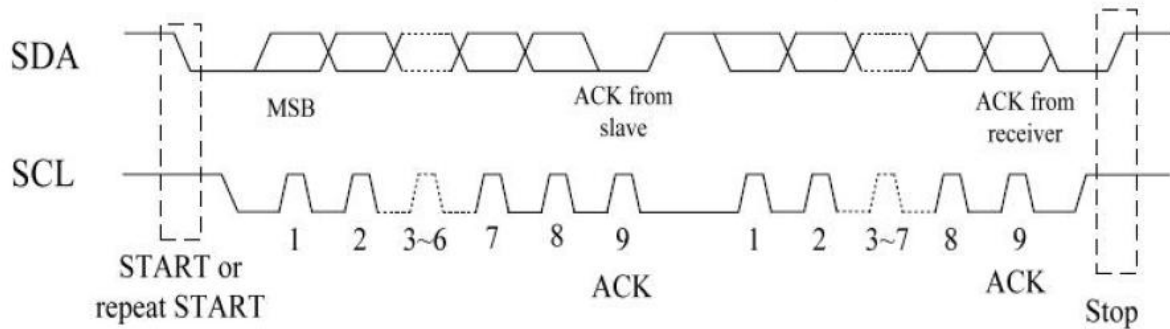
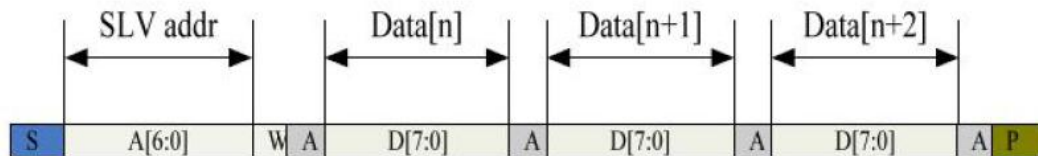


Figure 2-5 I2C master write, slave read

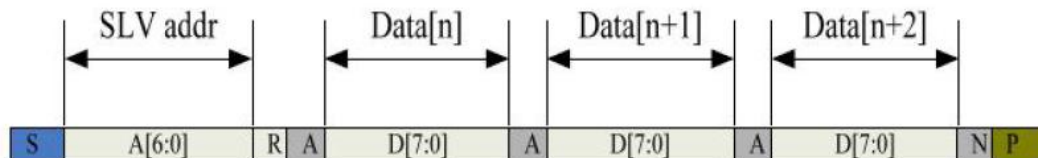


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the mnemonics used in the above figures.

**Table 2-1 Mnemonics Description**

| Mnemonics | Description                                                                                                                                              |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| S         | I2C Start or I2C Restart                                                                                                                                 |
| A[6:0]    | Slave address<br>A[6:4]: 3'b011<br>A[3:0]: data bits are identical to those of I2CCON[7:4] register.                                                     |
| W         | 1'b0: Write                                                                                                                                              |
| R         | 1'b1: Read                                                                                                                                               |
| A(N)      | ACK(NACK)                                                                                                                                                |
| P         | STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet) |

I2C Interface Timing Characteristics is shown in Table 2-2.

**Table 2-2 I2C Timing Characteristics**

| Parameter                                        | Unit | Min | Max |
|--------------------------------------------------|------|-----|-----|
| SCL frequency                                    | KHz  | 0   | 400 |
| Bus free time between a STOP and START condition | us   | 4.7 | \   |
| Hold time (repeated) START condition             | us   | 4.0 | \   |
| Data setup time                                  | ns   | 250 | \   |
| Setup time for a repeated START condition        | us   | 4.7 | \   |
| Setup Time for STOP condition                    | us   | 4.0 | \   |

## 7. Optical Characteristics

| Items                |       | Symbol            | Condition                                        | Min. | Typ. | Max. | Unit              | Remark           | Note  |
|----------------------|-------|-------------------|--------------------------------------------------|------|------|------|-------------------|------------------|-------|
| Response time        |       | Tr+Tf             | -                                                | -    | 35   | 45   | ms                | FIG.1            | Note4 |
| Contrast Ratio       |       | CR                |                                                  | 640  | 800  | -    | -                 | FIG.2            | Note1 |
| Surface luminance    |       | LV                | $\theta = 0^\circ$                               | -    | 250  | -    | cd/m <sup>2</sup> | FIG.2            | Note2 |
| Luminance uniformity |       | Yu                | $\theta = 0^\circ$                               | 80   | -    | -    | %                 | FIG.2            | Note3 |
| NTSC                 |       | -                 | $\theta = 0^\circ$                               | -    | 60   | -    | %                 | FIG.2            | Note5 |
| Viewing angle        |       | $\theta$<br>Cr>10 | $\phi = 90^\circ$                                | -    | 80   | -    | deg               | FIG.3            | Note6 |
|                      |       |                   | $\phi = 270^\circ$                               | -    | 80   | -    | deg               | FIG.3            |       |
|                      |       |                   | $\phi = 0^\circ$                                 | -    | 80   | -    | deg               | FIG.3            |       |
|                      |       |                   | $\phi = 180^\circ$                               | -    | 80   | -    | deg               | FIG.3            |       |
| Chromaticity         | Red   | R <sub>x</sub>    | $\theta = 0^\circ$<br>$\phi = 0^\circ$<br>Ta=25° | TBD  | TBD  | TBD  | TBD               | FIG.2<br>CIE1931 | Note5 |
|                      |       | R <sub>y</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |
|                      | Green | G <sub>x</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |
|                      |       | G <sub>y</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |
|                      | Blue  | B <sub>x</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |
|                      |       | B <sub>y</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |
|                      | White | W <sub>x</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |
|                      |       | W <sub>y</sub>    |                                                  | TBD  | TBD  | TBD  | TBD               |                  |       |

**Note1. Definition of contrast ratio**

Contrast ratio(Cr) is defined mathematically by the following formula. For more information see FIG.2.

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

For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is based on TOPCON's BM-5 or BM-7 photo detector or compatible.

**Note2. Definition of surface luminance.**

Surface luminance is the luminance with all pixels displaying white. For more information see FIG.2.

$L_v$  = Average Surface Luminance with all white pixels ( $P_1, P_2, P_3, \dots, P_n$ )

**Note3. Definition of luminance uniformity**

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

$$YU = \frac{\text{Minimum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}{\text{Maximum surface luminance with all white pixels } (P_1, P_2, P_3, \dots, P_n)}$$

**Note4. 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%.

For additional information see FIG1.

**Note5. Definition of color chromaticity (CIE1931)**

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

**Note6. Definition of viewing angle**

Viewing angle is the angle at which the contrast ratio is greater than 10. 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 LCD surface. For more information see FIG.3.

For viewing angle and response time testing, the testing data is based on Autronic-Melchers' s ConoScope or DMS series Instruments or compatible.

FIG.1.The definition of response Time

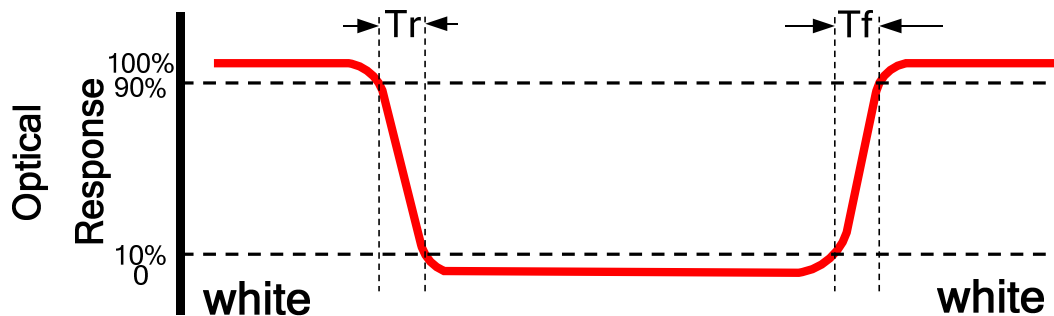


FIG.2. Measuring method for contrast ratio, surface luminance,

luminance uniformity, CIE (x,y) chromaticity

Size :  $S \leq 5"$  (see Figure a) A : 5 mm B : 5 mm

H,V : Active area

Light spot size  $\varnothing = 5\text{mm}$  (BM-5) or  $\varnothing = 7.7\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

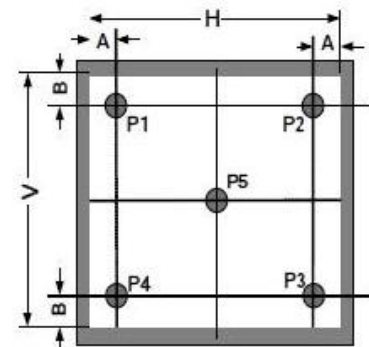


Figure a

Size :  $5" < S \leq 12.3"$  (see Figure b) H,V : Active area

Light spot size  $\varnothing = 5\text{mm}$  (BM-5) or  $\varnothing = 7.7\text{mm}$  (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure b.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

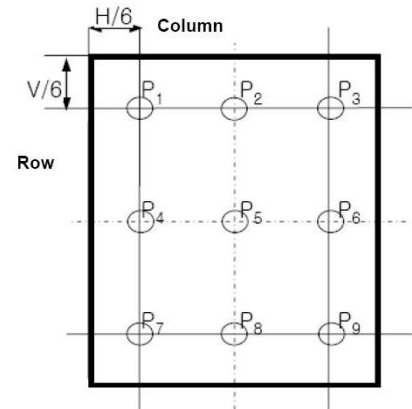


Figure b

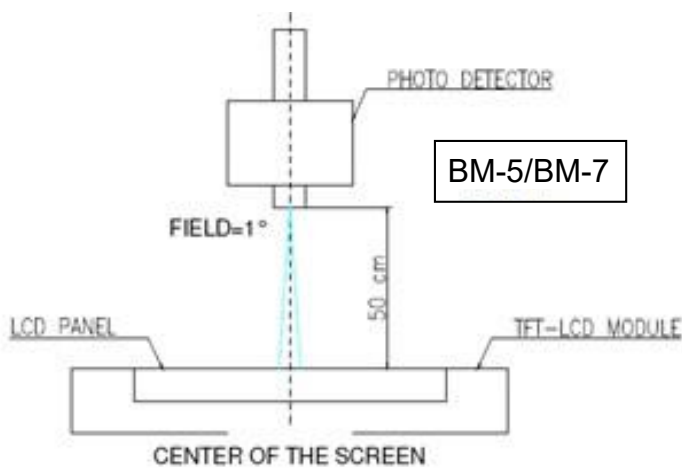
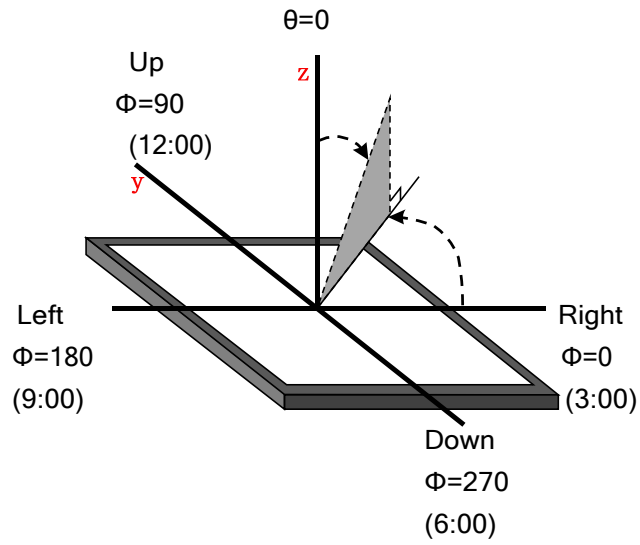


Figure c

FIG.3.The definition of viewing angle

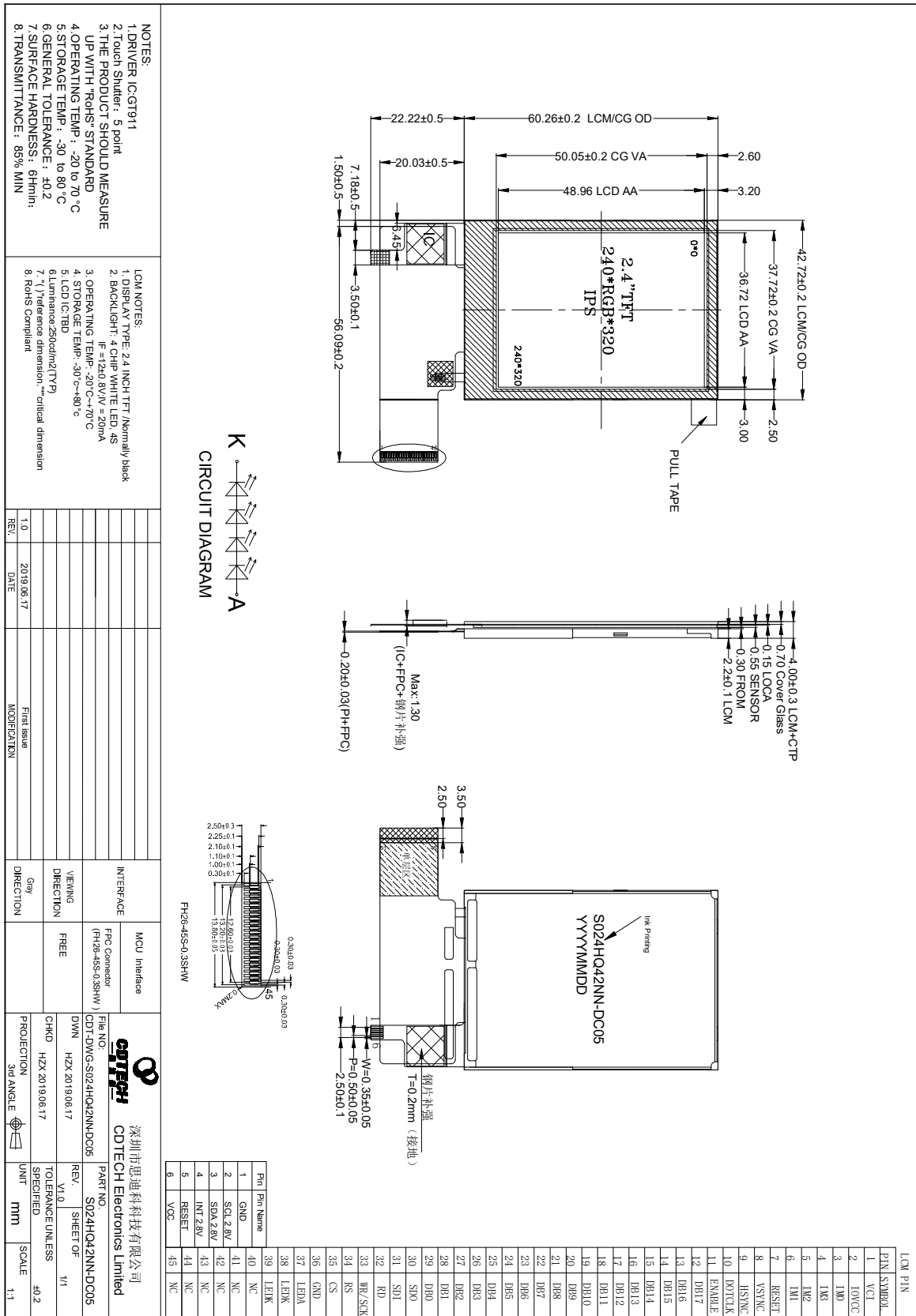


## 8. Environmental / Reliability Tests

| No | Test Item                            | Condition                                                                                                                            | Remarks                                                                                  |
|----|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 1  | High Temperature Operation           | Ts= +70°C, 96hrs                                                                                                                     | Note 1<br>IEC60068-2-2,<br>GB2423. 2-89                                                  |
| 2  | Low Temperature Operation            | Ta= -20°C, 96hrs                                                                                                                     | Note 2 IEC60068-2-1<br>GB2423.1-89                                                       |
| 3  | High Temperature Storage             | Ta= +80°C, 96hrs                                                                                                                     | IEC60068-2-2<br>GB2423. 2-89                                                             |
| 4  | Low Temperature Storage              | Ta= -30°C, 96hrs                                                                                                                     | IEC60068-2-1<br>GB/T2423.1-89                                                            |
| 5  | High Temperature & Humidity Storage  | Ta= +60°C, 90% RH max,96 hours                                                                                                       | IEC60068-2-3<br>GB/T2423.3-2006                                                          |
| 6  | Thermal Shock (Non-operation)        | -20°C 30 min ~ +60°C 30 min<br>Change time: 5min, 30 Cycle                                                                           | Start with cold temperature, end with high temperature<br>IEC60068-2-14,<br>GB2423.22-87 |
| 7  | Electro Discharge (Operation) Static | C=150pF, R=330 Ω, 5 points/panel<br>Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15°C ~ 35°C, 30% ~ 60%, 86Kpa ~ 106Kpa) | IEC61000-4-2<br>GB/T17626.2-1998                                                         |
| 8  | Vibration (Non-operation)            | Frequency range: 10~55Hz, Stroke: 1mm Sweep: 10Hz~55Hz~10Hz<br>2 hours for each direction of X .Y. Z. (package condition)            | IEC60068-2-6<br>GB/T2423.5-1995                                                          |
| 9  | Shock (Non-operation)                | 60G 6ms, ± X, ±Y , ± Z<br>3 times for each direction                                                                                 | IEC60068-2-27<br>GB/T2423.5-1995                                                         |
| 10 | Package Drop Test                    | Height: 80 cm, 1 corner, 3 edges, 6 surfaces                                                                                         | IEC60068-2-32<br>GB/T2423.8-1995                                                         |

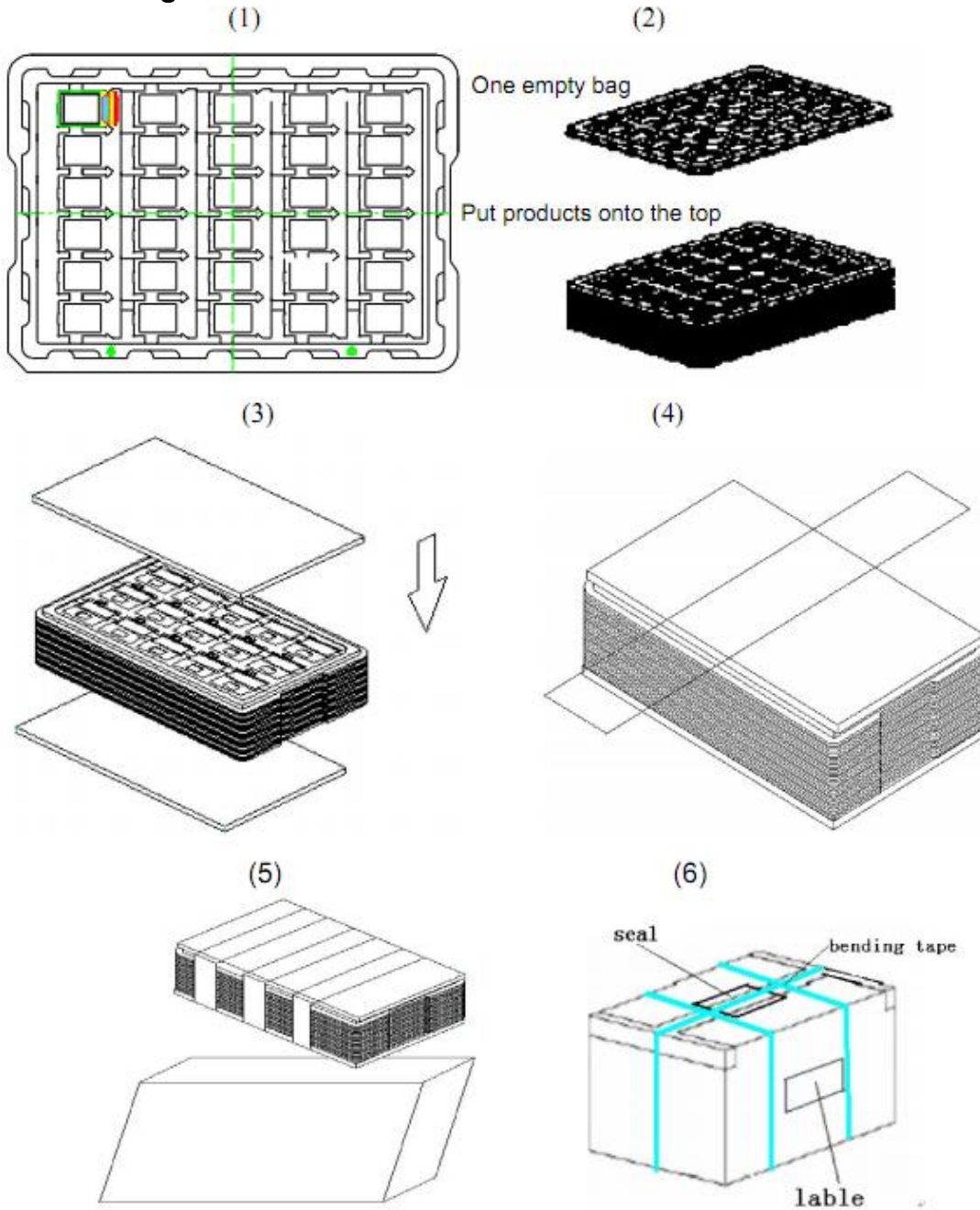
Note:1. Ts is the temperature of panel's surface.  
2. Ta is the ambient temperature of sample.  
3. The size of sample is 5pcs.

## 9. Mechanical Drawing



## 10. Packing

### Packing Method



1. Put module into tray cavity:
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above:
4. Fix the cardboard to the tray stack with adhesive tape:
5. Put the tray stack into carton.
6. Carton sealing with adhesive tape.

## 11. Precautions for Use of LCD modules

### 11.1 Handling Precautions

11.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

11.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketene
- Aromatic solvents

11.1.6. Do not attempt to disassemble the LCD Module.

11.1.7. If the logic circuit power is off, do not apply the input signals.

11.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

11.1.8.1. Be sure to ground the body when handling the LCD Modules.

11.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.

11.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

11.1.8.4. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 11.2 Storage Precautions

11.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0°C ~ 40°C      Relatively humidity: ≤80%

11.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

## 11.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.