

MODEL NO. : TM035HBHT1ISSUED DATE: 2010-11-16VERSION : Ver 2.0

- ☐ Preliminary Specification
☒ Final Product Specification

Customer :

| Approved by | Notes |
|-------------|-------|
| | |

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| | | |

This technical specification is subjected to change without notice



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**Record of Revision**

| Rev | Issued Date | Description | Editor |
|-----|-------------|--|-------------|
| 1.0 | 2010-06-22 | Preliminary release. | Haitao Chen |
| 1.1 | 2010-07-12 | 1.revise type contrast ratio from 100 to 150 2.revise chromaticity x:3.20→3.01;y:3.30→3.21 3.update power supply current(15mA) | Haitao Chen |
| 2.0 | 2010-11-16 | Add Touch panel Pin Assignment---page 6 | Lu Bai |
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1. General Specifications

| Feature | | Spec |
|----------------------------|---------------------------------|------------------------|
| Display Spec. | Size | 3.5 inch |
| | Resolution | 240(RGB) x 320 |
| | Interface | RGB 6 bit + SPI |
| | Color Depth | 262K |
| | Technology Type | a-Si |
| | Pixel Pitch (mm) | 0.2235x0.2235 |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Display Mode | Transflective |
| | Surface Treatment(Up Polarizer) | HC |
| | Viewing Direction | 6 o'clock |
| | Gray Scale Inversion Direction | 12 o'clock |
| | LCM (W x H x D) (mm) | 64.0x85.0x4.13 |
| Mechanical Characteristics | Active Area(mm) | 53.64x71.52 |
| | With /Without TSP | With TSP |
| | Weight (g) | TBD |
| | LED Numbers | 6 LEDs |

Note 1: Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: $\pm 5\%$



2. Input/Output Terminals

2.1 J1 Pin Assignment

Connector type: FH12A-50S-0.5SH

| No | Symbol | I/O | Description | Comment |
|----|--------|-----|------------------------------------|---------|
| 1 | VL1 | P | Power supply for LED(High voltage) | |
| 2 | GND | P | Ground | |
| 3 | VL2 | P | Power supply for LED(Low voltage) | |
| 4 | GND | P | Ground | |
| 5 | VSHD | P | Power supply for digital | |
| 6 | GND | P | Ground | |
| 7 | GND | P | Ground | |
| 8 | GND | P | Ground | |
| 9 | VSYNC | I | Vertical sync. in RGB mode | |
| 10 | GND | P | Ground | |
| 11 | RESET | I | Reset(Low active) | |
| 12 | GND | P | Ground | |
| 13 | GND | P | Ground | |
| 14 | GND | P | Ground | |
| 15 | CS | I | Chip select input(Low enable) | |
| 16 | GND | P | Ground | |
| 17 | SDO | O | Serial data output | |
| 18 | SDI | I | Serial data input | |
| 19 | GND | P | Ground | |
| 20 | SCL | I | Serial interface clock | |
| 21 | GND | P | Ground | |
| 22 | B5 | I | Blue data input(MSB) | |
| 23 | B4 | I | Blue data input | |
| 24 | B3 | I | Blue data input | |
| 25 | B2 | I | Blue data input | |
| 26 | B1 | I | Blue data input | |
| 27 | B0 | I | Blue data input(LSB) | |
| 28 | ENAB | I | Data enable in RGB mode | |
| 29 | GND | P | Ground | |
| 30 | HSYNC | I | Horizontal sync. in RGB mode | |
| 31 | GND | P | Ground | |
| 32 | DCLK | I | Pixel clock signal in RGB mode | |
| 33 | GND | P | Ground | |
| 34 | G5 | I | Green data input(MSB) | |
| 35 | G4 | I | Green data input | |
| 36 | G3 | I | Green data input | |
| 37 | G2 | I | Green data input | |
| 38 | G1 | I | Green data input | |
| 39 | G0 | I | Green data input(LSB) | |
| 40 | GND | P | Ground | |
| 41 | R5 | I | Red data input(MSB) | |
| 42 | R4 | I | Red data input | |
| 43 | R3 | I | Red data input | |
| 44 | R2 | I | Red data input | |

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| | | | | |
|----|-----|---|---------------------|--|
| 45 | R1 | I | Red data input | |
| 46 | R0 | I | Red data input(LSB) | |
| 47 | GND | P | Ground | |
| 48 | GND | P | Ground | |
| 49 | GND | P | Ground | |
| 50 | GND | P | Ground | |

Note1: I/O definition:

I----Input O----Output P----Power/Ground

2.2 Touch panel Pin Assignment

| Pin | Symbol | I/O | Description | Remark |
|-----|--------|-----|------------------|--------|
| 1 | YU | O | Y+ Channel input | |
| 2 | XR | O | X+ Channel input | |
| 3 | YD | O | Y- Channel input | |
| 4 | XL | O | X- Channel input | |

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

| Item | Symbol | Min | Max | Unit | Remark |
|----------------------------|---------|-------|------------|------|--------|
| Supply Voltage | VSHD | -0.3 | 4.6 | V | |
| Driver supply voltage | VGH-VGL | -0.3 | +32.0 | V | |
| Logic input voltage range | VIN | -0.3 | VSHD + 0.3 | V | |
| Logic output voltage range | VO | -0.3 | VSHD + 0.3 | V | |
| Operating temperature | Top | -20.0 | 60.0 | ℃ | Note1 |
| Storage temperature | Tst | -30.0 | 70.0 | ℃ | Note1 |

Note1: The parameter is for driver IC (gate driver, source driver) only.

Note2: Signals include R0~R5, G0~G5, B0~B5, DCLK, Hsync, Vsync, Reset, CS, SDI, SCL, ENABLE

Table 3.1 absolute maximum rating



4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|------------------------------|-----------------|-----------------|---------|------|---------|---|
| Supply Voltage | VCC | 2.5 | 2.8 | 3.2 | V | |
| Gate on voltage | VGH | 13.5 | 15.0 | 16.5 | V | |
| Gate off voltage | VGL | -11.0 | -10.0 | -9.0 | V | |
| Input Signal Voltage | Low Level | V _{IL} | 0 | - | 0.3xVCC | R0~R5;G0~G5;B0~B5 DOTCLK; Hsync; Vsync ENABLE; R/L; U/D |
| | High Level | V _{IH} | 0.7xVCC | - | VCC | |
| Current of VSHD Power supply | I _{CC} | - | 15 | - | mA | Note 1 |

Note1: For different LCM, the value may have a bit of difference.

Note2: To test the current dissipation, use "all Black Pattern".

Table 4.1 LCD module electrical characteristics

4.2 Driving Backlight

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|-----------------------------|-----------------|--------|------|-----|------|--------|
| Forward Current | I _F | - | 20 | - | mA | |
| Forward Voltage | V _{BL} | - | 19.2 | - | V | |
| Backlight Power Consumption | W _{BL} | - | 384 | - | mW | |
| Life Time | - | 10,000 | - | - | Hrs | Note 3 |

Note 1: I_F is defined for one channel LED. There are total three LED channels in back light unit

Note 2: Optical performance should be evaluated at Ta=25℃ 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.

Table 4.2 LED backlight characteristics

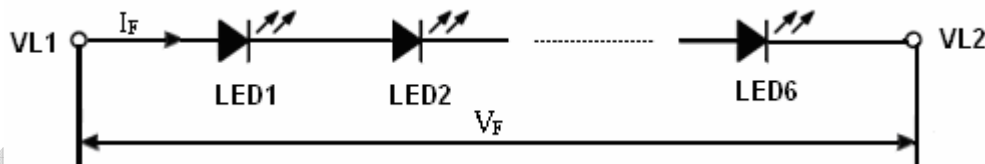
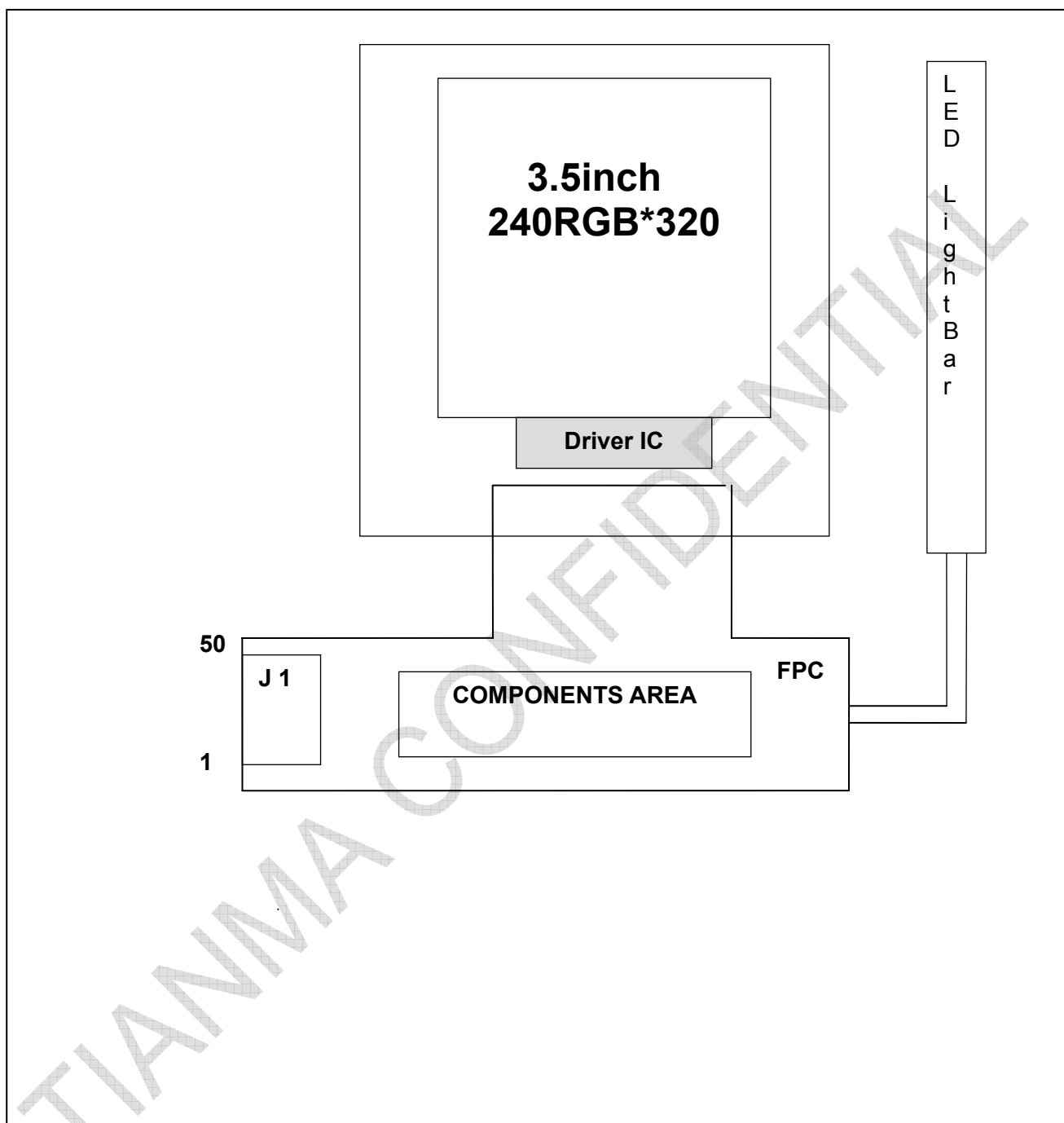


Figure 4.2 LED connection of backlight



4.3 Block Diagram





5. Data input timing

5.1 Signal AC Timing

(VSHD=2.5~3.2V, Ta=25°C)

| Parameter | Description | Min | Max | Unit | Remark |
|---------------|------------------------------|-----|-----|------|--------|
| tSYNCS | VSYNCS/HSYNCS setup time | 15 | | ns | |
| tSYNCH | VSYNCS/HSYNCS hold time | 15 | | ns | |
| tENS | ENAB setup time | 15 | | ns | |
| tENH | ENAB hold time | 15 | | ns | |
| tPOS | Data setup time | 15 | | ns | |
| tPDH | Data hold time | 15 | | ns | |
| PWDH | DCLK high-level period | 15 | | ns | |
| PWDL | DCLK low-level period | 15 | | ns | |
| tCYCD | DCLK cycle time | 100 | | ns | |
| trgbr , trgbf | DCLK,HSYNCS,VSYNCS rise/fall | | 15 | ns | |

Table 5.1 RGB Interface Characteristics

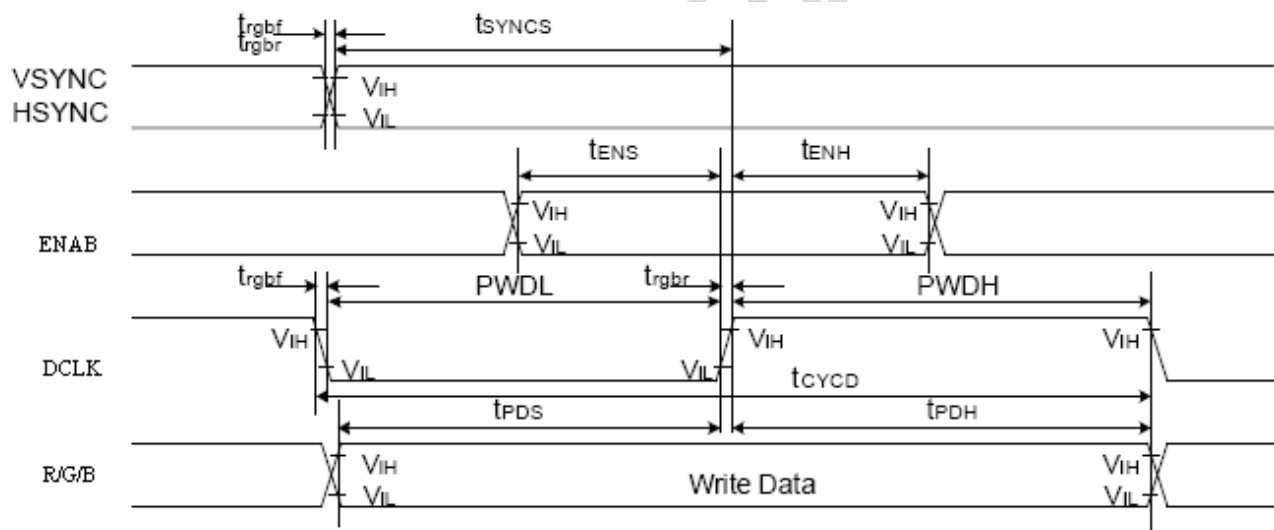


Fig.5-1 RGB Interface Timing

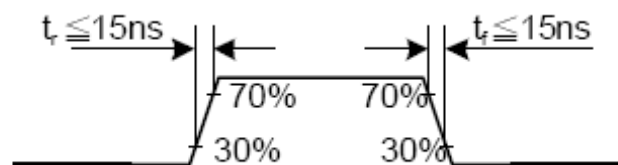


Fig.5-2 Input signal's rise and fall times



5.2 Recommend RGB Interface Timing

(VSHD=2.5~3.2V, Ta=25°C)

| Parameter | Symbol | Symbol | Min | Typ | Max | Unit | Remark |
|-----------|------------------------|--------|-----|--------|-----|------|--------|
| DCLK | DCLK frequency | fDCYC | - | 5.64 | 10 | MHz | |
| | DCLK period | tDCYC | 100 | 177.15 | - | ns | |
| HSYNC | Horizontal | Thd | 240 | | | DCLK | |
| | 1horizontalline | Th | - | 310 | - | | |
| | Horizontal blank | Thb | 56 | 60 | - | | |
| | Horizontal front porch | Thfp | 2 | 10 | 16 | | |
| VSYNC | Vertical display area | Tvd | 320 | | | Line | |
| | Vsync period time | Tv | - | 328 | - | | |
| | Vsync blank | Tvb | 2 | 4 | - | | |
| | Vsync Front porch | Tvfp | 2 | 4 | - | | |

Tab.5-2 Recommend Input Timing (DCLK, HSYNC, VSYNC, ENAB)

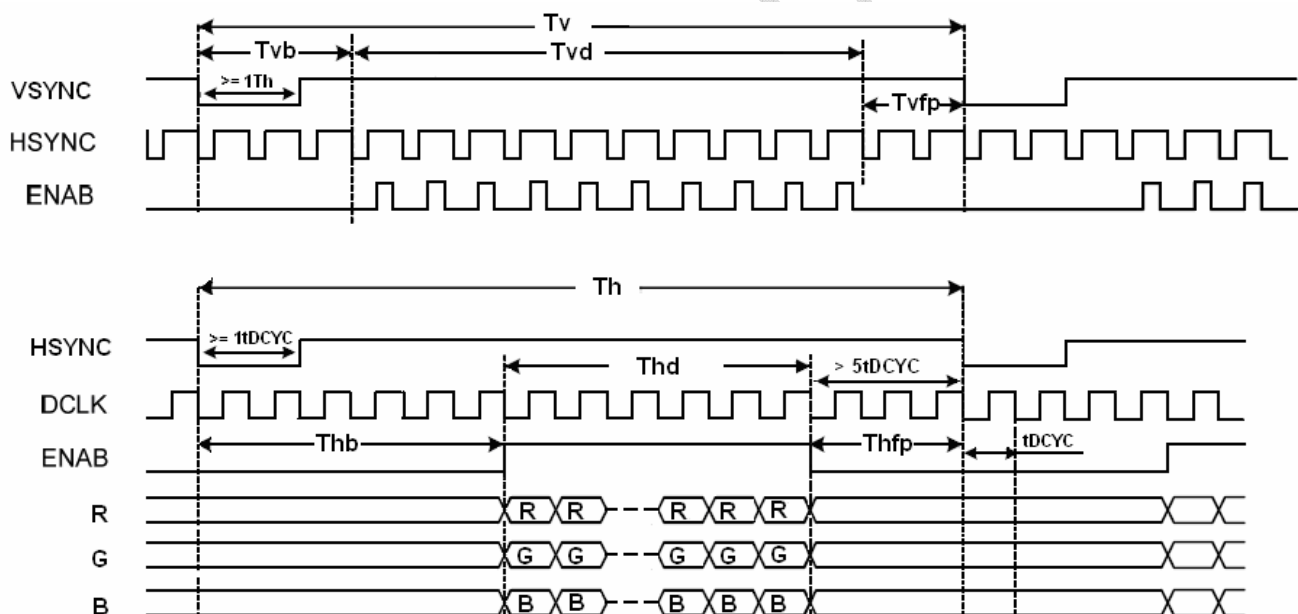


Fig.5-3 Recommend RGB Interface Timing



5.2 3-Wire 9-Bit Serial Interface

5.2.1 3-Wire 9-Bit data serial interface write mode

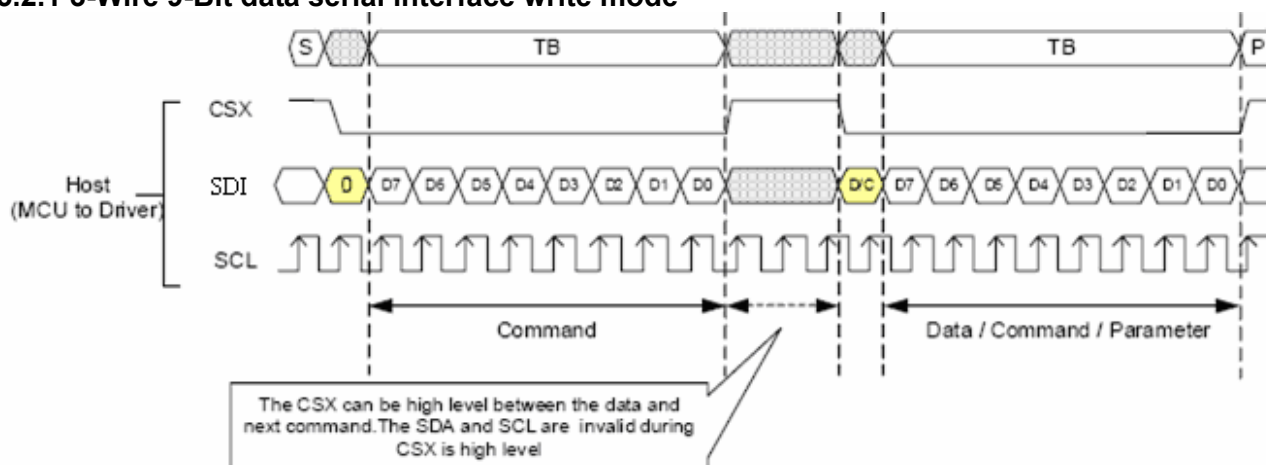


Figure. 5-4 3-Wire 9-Bit Serial Interface I Bus Protocol, Write to Register or Display RAM

Note: D/C = 0, Transfer Command; D/C = 1, Transfer Data.

5.2.2 3-Wire 9-Bit data serial interface read 1-byte mode

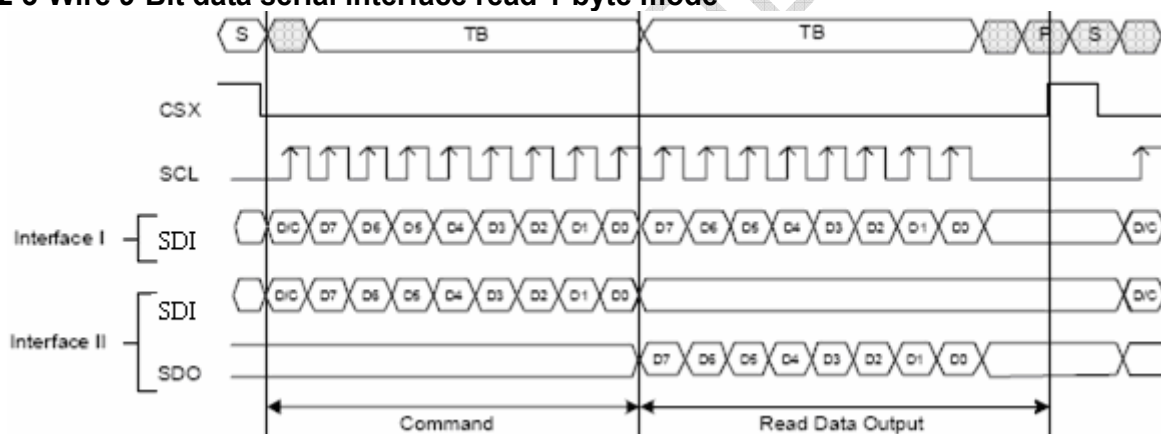


Figure. 5-5 3-Wire 9-Bit Serial Interface I/II Bus Protocol, Read 1-Byte From Register

Note: D/C=0, Transfer Command; D/C=1, Transfer Data.



5.2.3 3-Wire 9-Bit data serial interface read 3-byte mode

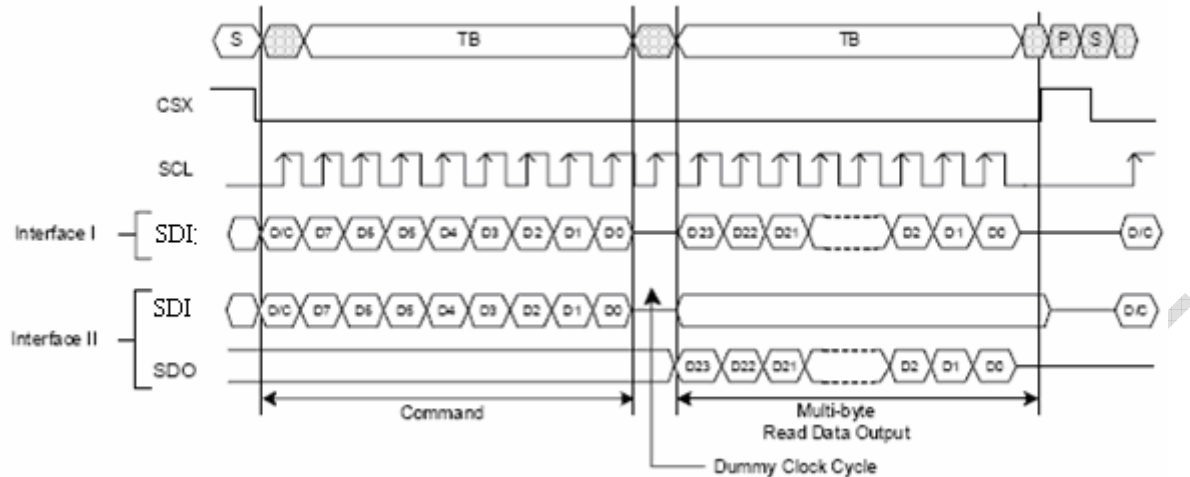


Figure. 5-6 3-Wire 9-Bit Serial Interface I/II Bus Protocol, Read 3-Byte From Register

Note: D/C=0, Transfer Command; D/C=1, Transfer Data.

5.2.4 3-Wire 9-Bit serial interface Timing

(VSHD=2.5~3.2V, Ta=25°C)

| Parameter | Symbol | Conditions | Min | Max | Unit | Remark |
|----------------------------|--------|------------|-----|-----|------|--------|
| Serial Clock Cycle(Write) | tscycw | SCL | 100 | - | ns | |
| SCL "H" pluse width(Write) | tshw | SCL | 40 | - | ns | |
| SCL "L" pluse width(Write) | tslw | SCL | 40 | - | ns | |
| Data setup time(Write) | tsds | SDI | 30 | - | ns | |
| Data hold time(Write) | tsdh | SDI | 30 | - | ns | |
| Serial Clock Cycle(Read) | tscycr | SCL | 150 | - | ns | |
| SCL "H" pluse width(Read) | tshr | SCL | 60 | - | ns | |
| SCL "L" pluse width(Read) | tslr | SCL | 60 | - | ns | |
| Access time | tacc | SDO(Read) | 10 | | ns | |
| Output disable time | toh | SDO(Read) | 10 | 50 | ns | |
| CS "H" pluse width | tch | CS | 40 | - | ns | |
| CS-SCL time | tcss | CS (Write) | 60 | - | ns | |
| | tcsh | CS (Write) | 65 | - | ns | |

Tab.5-3 AC Characteristics of 3-Wire 9-Bit Serial Interface

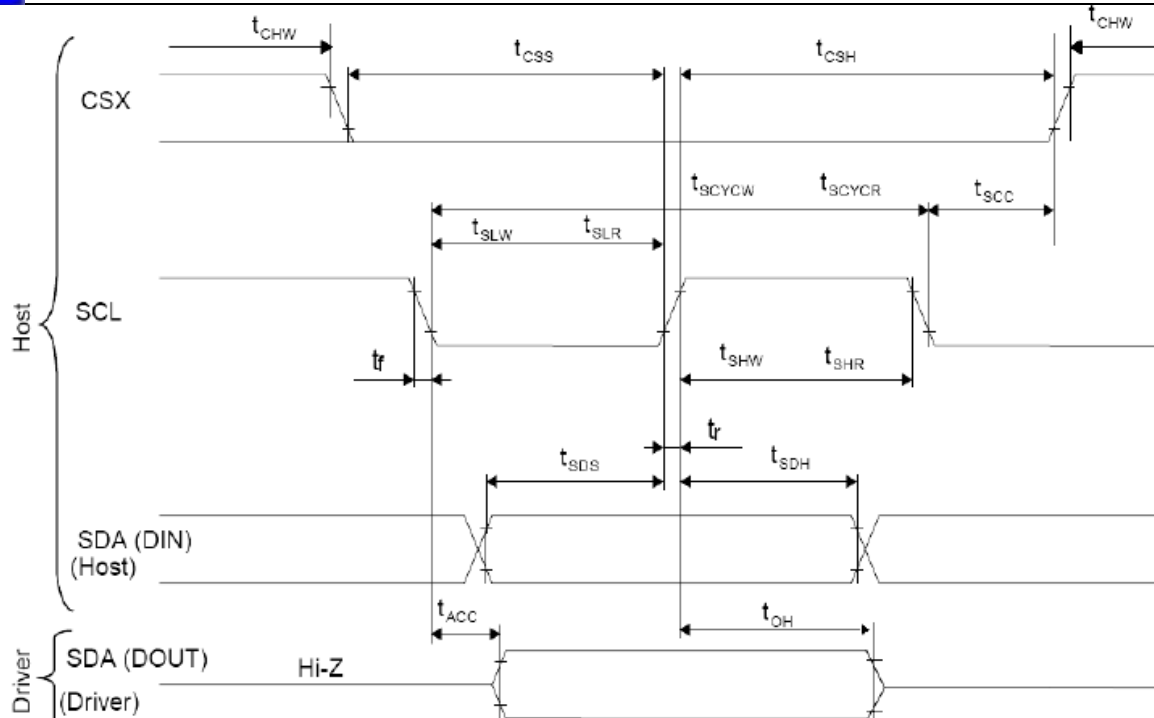


Fig.5-7 AC Characteristics of 3-Wire 9-Bit Serial Interface timing

5.3 Reset Timing

| Parameter | Symbol | MIN | TYP | MAX | Unit | Remark |
|-----------|--------|-----|-----|-----|------|--------|
| RESET | tRW | 10 | - | - | us | - |
| | tRT | - | - | 5 | ms | note 1 |
| | tRT | - | - | 120 | ms | note 2 |

Tab.5-4 Reset input timing

Note1: When Reset applied during Sleep In Mode.

Note2: When Reset applied during Sleep Out Mode.

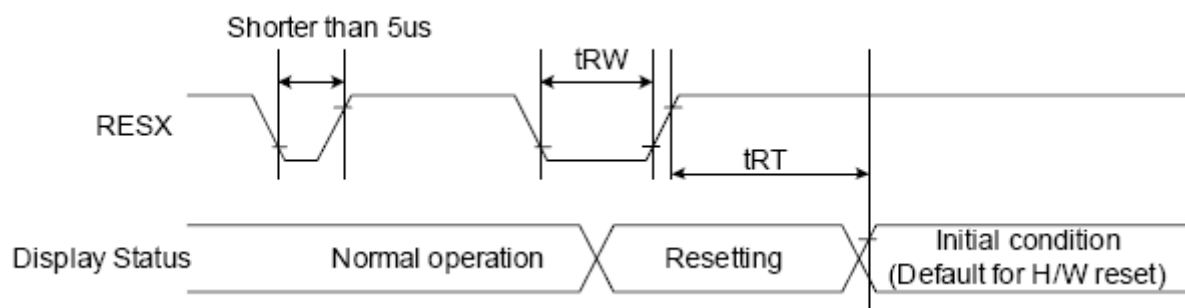


Fig.5-8 Reset timing

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5.4 Power ON/OFF Sequence

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---|--------|-----|-----|-----|------|--------|
| VSHD to RESET2 ending/ RESET2 starting to VSHD | t1 | 10 | | | ms | |
| RESET2 ending to SPI starting/ SPI ending to RESET2 starting | t2 | 10 | - | 50 | ms | |
| SPI starting to RGB starting/ RGB ending to SPI ending | t3 | 20 | - | 50 | ms | |
| RGB starting to BLU starting/ BLU ending to RGB ending | t4 | 50 | - | - | ms | |
| RGB ending to RESET1 starting | t5 | 20 | - | - | ms | |

Table 5.5 Power on/off sequence

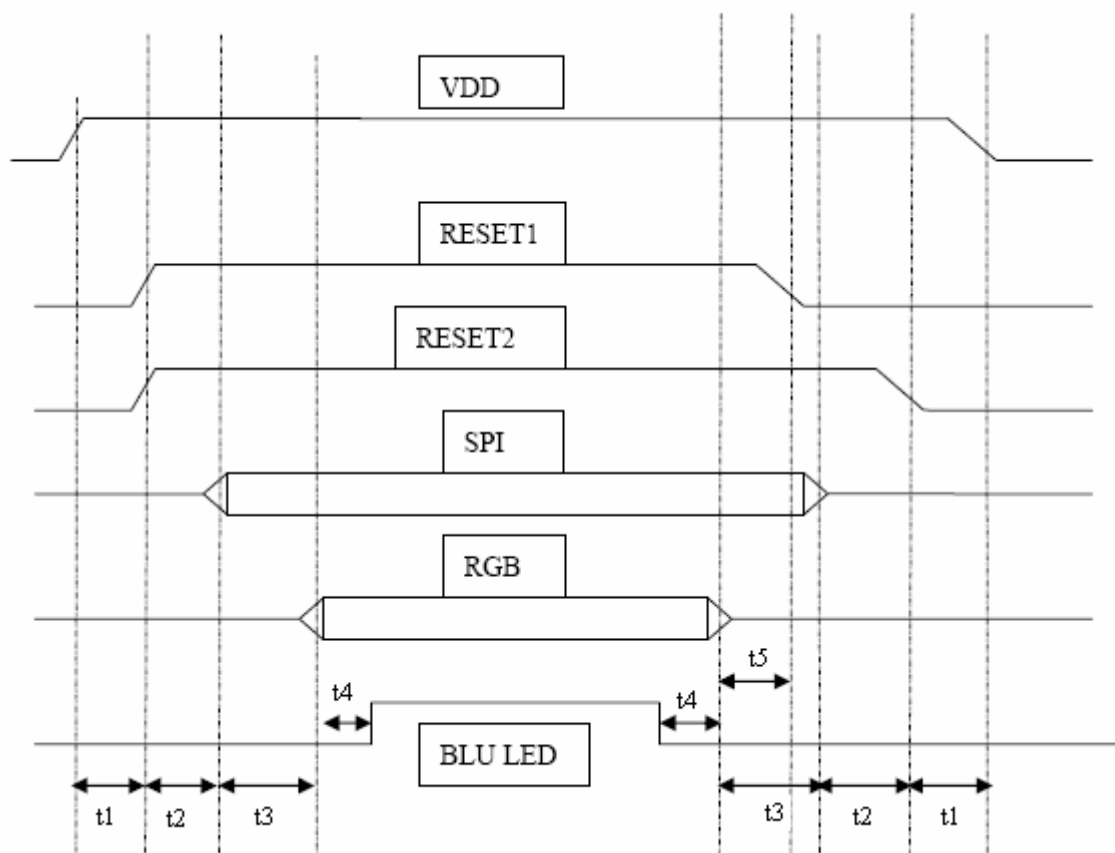


Figure 5.5 Power on/off sequence

Note1: RESET1 Power down in sleep out mode.

Note2: RESET2 Power down in sleep in mode.



6. Optical Characteristics

6.1 Driving the backlight condition

Ta=25℃

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|----------------|------------|------------------|-----|-------|-----|-------------------|-------------|
| View Angles | θT | $CR \geq 10$ | -- | 55 | 60 | Degree | Note 2 |
| | θB | | -- | 40 | 45 | | |
| | θL | | -- | 40 | 45 | | |
| | θR | | -- | 45 | 50 | | |
| Contrast Ratio | CR | $\theta=0^\circ$ | 100 | 150 | -- | | Note1、Note3 |
| Response Time | T_{ON} | 25℃ | -- | 35 | -- | ms | Note1 |
| | T_{OFF} | | | | | | Note4 |
| Chromaticity | White | Backlight is on | -- | 0.301 | -- | | Note5 |
| | | | -- | 0.321 | -- | | Note1 |
| Luminance | L | | 60 | 80 | -- | cd/m ² | Note1、Note7 |

6.2 Not driving the backlight condition

Ta=25℃

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|----------------|------------|------------------|-----|-------|-----|--------|-------------|
| View Angles | θT | $CR \geq 2$ | -- | 60 | -- | Degree | Note 2 |
| | θB | | -- | 60 | -- | | |
| | θL | | -- | 55 | -- | | |
| | θR | | -- | 60 | -- | | |
| Contrast Ratio | CR | $\theta=0^\circ$ | -- | 6.5 | -- | | Note1、Note3 |
| Chromaticity | White | Backlight is off | -- | 0.310 | -- | | Note5 |
| | | | -- | 0.320 | -- | | Note1 |
| Reflectance | | | -- | 7.0 | -- | % | Note1、Note6 |

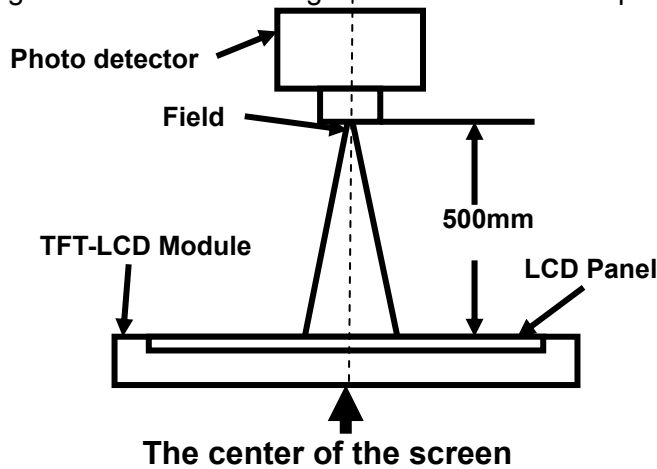
Test Conditions:

1. $I_F=20mA$, $V_F=19.2V$, the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.



Note 1: Definition of optical measurement system.

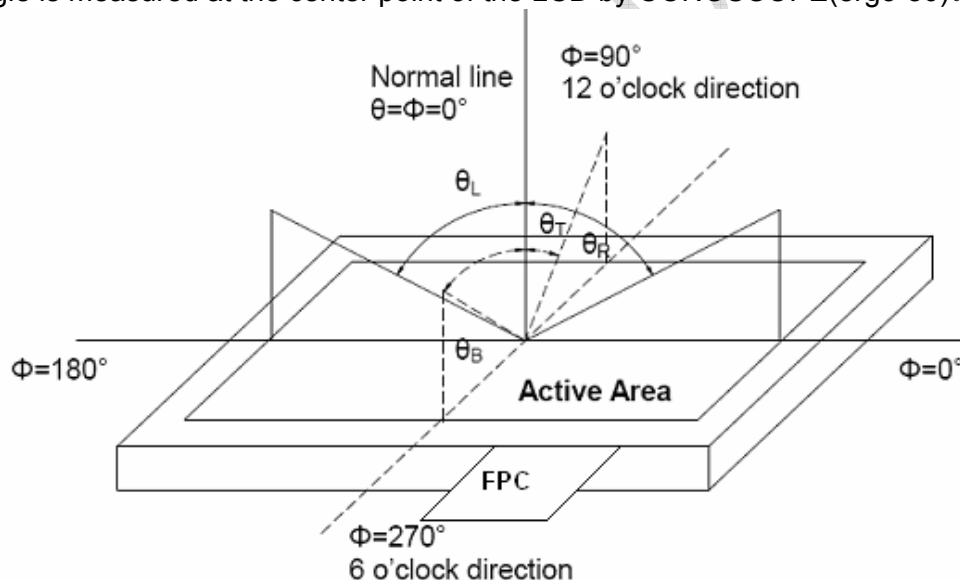
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



| Item | Photo detector | Field |
|----------------|----------------|-------|
| Contrast Ratio | SR-3A | 1° |
| Luminance | | |
| Chromaticity | | |
| Lum Uniformity | | |
| Response Time | BM-7A | 2° |

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

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

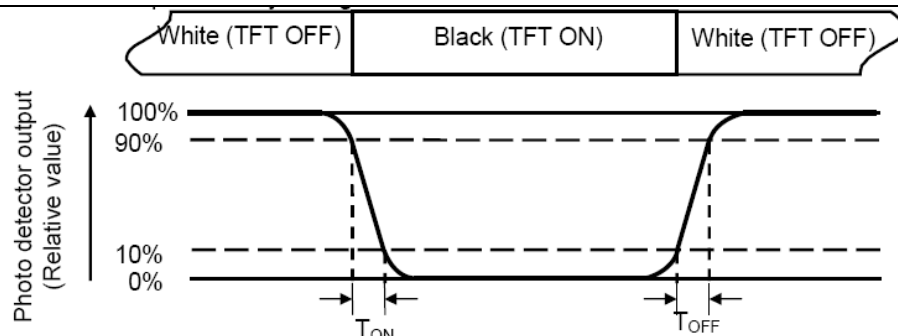
"White state": The state is that the LCD should drive by V_{white} .

"Black state": The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: 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_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



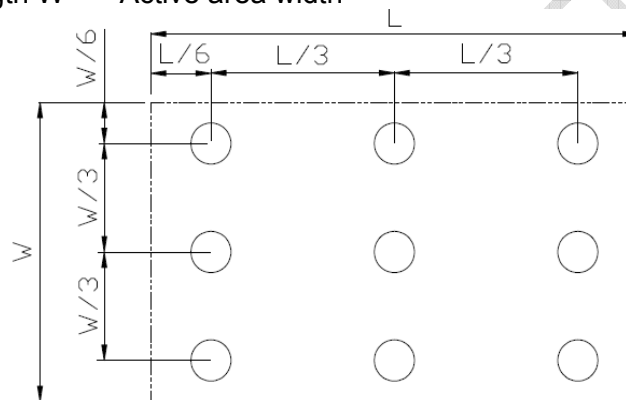
Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

L-----Active area length W----- Active area width



L_{max} : The measured Maximum luminance of all measurement position.

L_{min} : The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.



7. Environmental / Reliability Test

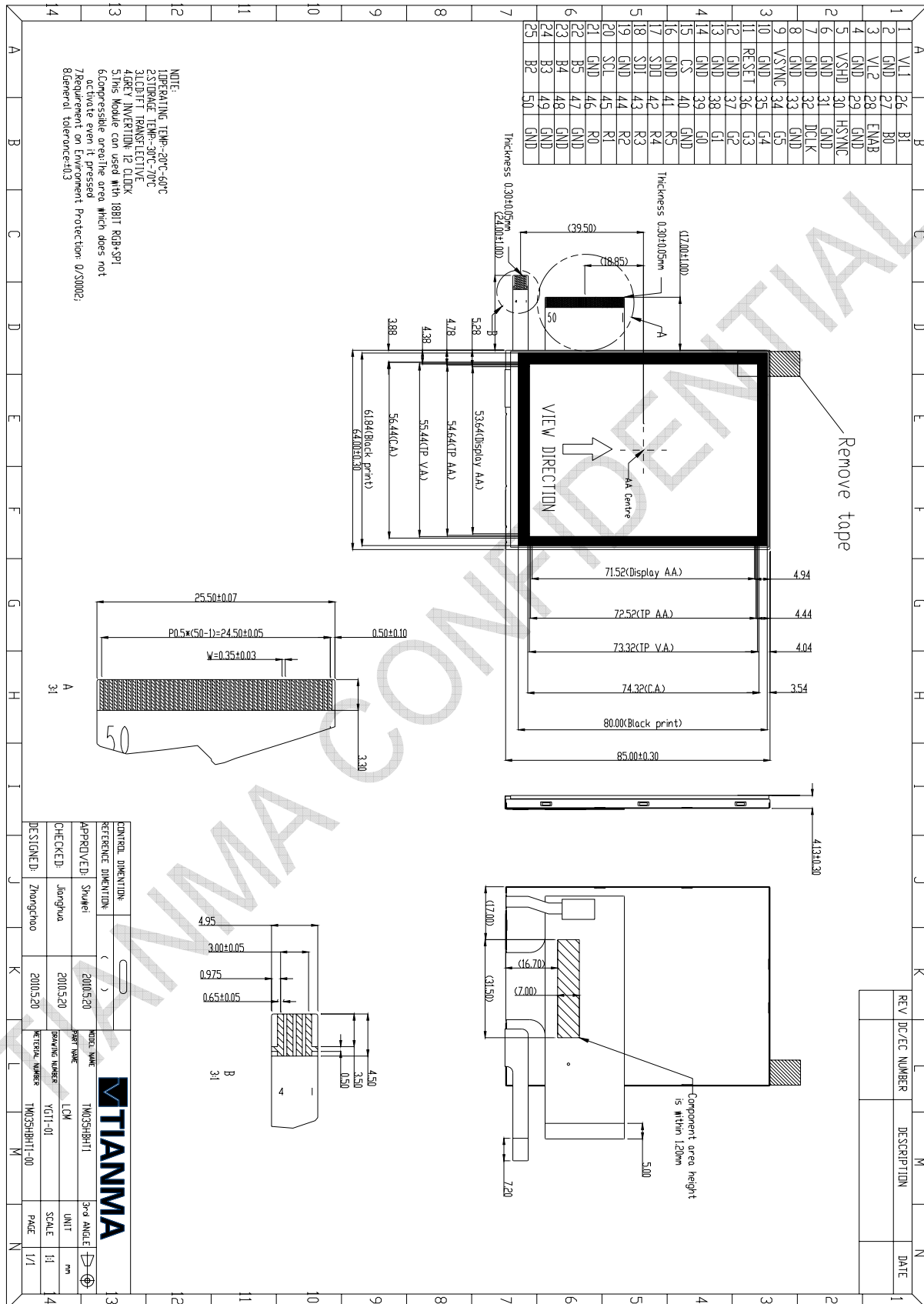
| No | Test Item | Condition | Remarks |
|----|--|---|---|
| 1 | High Temperature Operation | Ts = +60℃, 240 hours | Note1 IEC60068-2-1,GB2423.2 |
| 2 | Low Temperature Operation | Ta = -20℃, 240 hours | IEC60068-2-1 GB2423.1 |
| 3 | High Temperature Storage | Ta = +70℃, 240 hours | IEC60068-2-1 GB2423.2 |
| 4 | Low Temperature Storage | Ta = -30℃, 240 hours | IEC60068-2-1 GB2423.1 |
| 5 | Storage at High Temperature and Humidity | Ta = +40℃, 90% RH max,240hours | Note2 IEC60068-2-78 GB/T2423.3 |
| 6 | Thermal Shock (non-operation) | -30℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycle | Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22 |
| 7 | ESD | C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa) | IEC61000-4-2 GB/T17626.2 |
| 8 | Vibration Test | Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 30 minutes for each direction of X.Y.Z. (1.5 hours for total) | IEC60068-2-6 GB/T2423.10 |
| 9 | Mechanical Shock (Non Op) | Half Sine Wave 100G 6ms, ±X,±Y,±Z 3times for each direction | IEC60068-2-27 GB/T2423.5 |
| 10 | Package Drop Test | Height:60cm, 1corner,3edges,6surfaces | IEC60068-2-32 GB/T2423.8 |

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples.



8. Mechanical Drawing



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9. Packing Drawing

9.1 Packaging Material

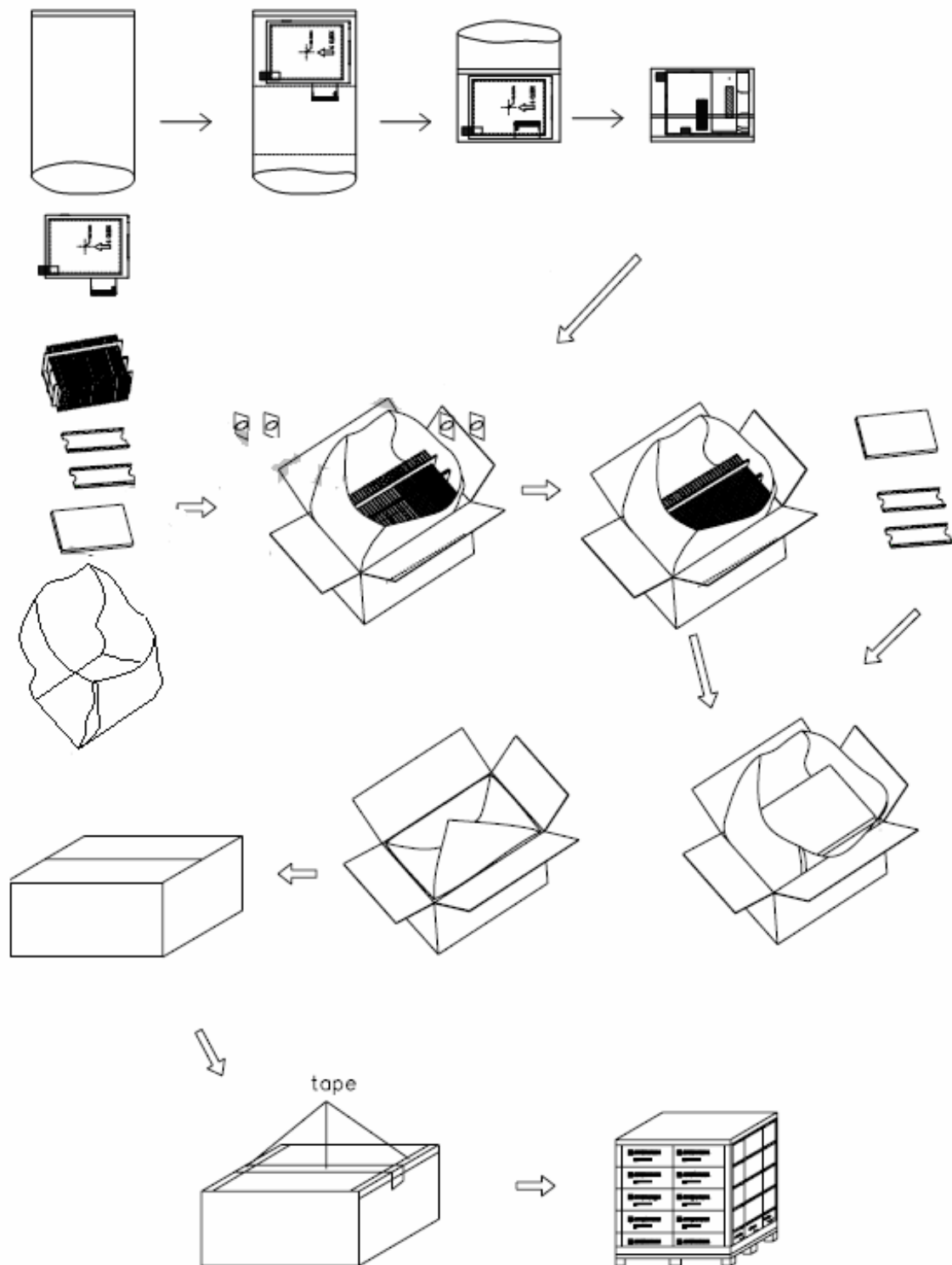
| No | Item | Model(Material) | Dimensions (mm) | Unit Weight (Kg) | Quantity | Remark |
|----|-----------------|------------------|-----------------|------------------|----------|-------------|
| 1 | LCM module | TM035HBHT1-00 | 64.0x85.0x2.93 | TBD | 112 | |
| 2 | Partition_1 | Corrugated paper | 513X333X106 | TBD | 2 | |
| 3 | Anti-static Bag | PE | 170X105X0.05 | 0.001 | 112 | Anti-static |
| 4 | Dust-Proof Bag | PE | 700X530 | 0.06 | 1 | |
| 5 | Partition_2 | Corrugated Paper | 505X332X4.0 | 0.098 | 3 | |
| 6 | Corrugated Bar | Corrugated paper | 513X126 | 0.048 | 8 | |
| 7 | Carton | Corrugated paper | 516X336X226 | 1.12 | 1 | |
| 8 | Total weight | TBD | | | | |

Note: Packaging Specification and Quantity

Module quantity in a carton: 28pcs(per row)x2(per column)x2= 112pcs



9.2 Packing Instruction





10. Precautions for Use of LCD Modules

10.1 Handling Precautions

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

10.1.2 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.

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

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

10.1.5 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
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

10.1.8.4 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.

10.2 Storage precautions

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

10.2.2 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℃ ~ 40℃ Relatively humidity: ≤80%

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

10.3 Transportation Precautions

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