

MODEL NO : TM035KDGP01

MODEL VERSION: 00

SPEC VERSION : 1.0

ISSUED DATE: 2019-08-27

- Preliminary Specification
 Final Product Specification

Customer : _____

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

TIANMA Confirmed :

| Prepared by | Checked by | Approved by |
|-------------|------------|-------------|
| Bei.Lei | | |

This technical specification is subjected to change without notice

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1. General Specifications

| | Feature | Spec |
|-----------------------------------|--------------------------------|---------------------------|
| Display Spec. | Size | 3.5inch |
| | Resolution | 320(RGB) X 240 |
| | Technology Type | a-Si |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Pixel pitch(mm) | 0.219 x 0.219 |
| | Display Mode | Normally Black |
| | Surface Treatment | HC |
| | Viewing Direction | All |
| | Gray Scale Inversion Direction | N/A |
| Mechanical Characteristics | LCM (W x H x D) (mm) | 76.9x63.9x3.15 |
| | Active Area(mm) | 70.08 x 52.56 |
| | With /Without TSP | Without TSP |
| | Connection Type | Kyocera elco:6240 serials |
| | LED Numbers | 6 LEDs |
| | Weight (g) | TBD |
| Electrical Characteristics | Interface | RGB 24bit+SPI or RGB24bit |
| | Color Depth | 16.7M |
| | Driver IC | ST7272A |

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: ROHS

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

2 Input/Output Terminals

2.1 TFT LCD Panel

Recommend connector: Kyocera elco:6240 serials

| No | Symbol | I/O/P | Description | Remarks |
|----|-------------|-------|--------------------------------|---------|
| 1 | LED_Cathode | P | LED_Cathode | |
| 2 | LED_Cathode | P | LED_Cathode | |
| 3 | LED_Anode | P | LED_Anode | |
| 4 | LED_Anode | P | LED_Anode | |
| 5 | NC | - | No Connect | |
| 6 | NC | - | No Connect | |
| 7 | NC | - | No Connect | |
| 8 | RESET | I | Reset | |
| 9 | SPENA | I | Serial port data enable signal | |
| 10 | SPCK | I | SPI Serial Clock | |
| 11 | SPDA | I/O | SPI Serial Data Input | |
| 12 | D00 | I | Data 00 | |
| 13 | D01 | I | Data 01 | |
| 14 | D02 | I | Data 02 | |
| 15 | D03 | I | Data 03 | |
| 16 | D04 | I | Data 04 | |
| 17 | D05 | I | Data 05 | |
| 18 | D06 | I | Data 06 | |
| 19 | D07 | I | Data 07 | |
| 20 | D08 | I | Data 08 | |
| 21 | D09 | I | Data 09 | |
| 22 | D10 | I | Data 10 | |
| 23 | D11 | I | Data 11 | |
| 24 | D12 | I | Data 12 | |
| 25 | D13 | I | Data 13 | |
| 26 | D14 | I | Data 14 | |
| 27 | D15 | I | Data 15 | |

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| | | | | |
|----|------------|---|---|--|
| 28 | D16 | I | Data 16 | |
| 29 | D17 | I | Data 17 | |
| 30 | D18 | I | Data 18 | |
| 31 | D19 | I | Data 19 | |
| 32 | D20 | I | Data 20 | |
| 33 | D21 | I | Data 21 | |
| 34 | D22 | I | Data 22 | |
| 35 | D23 | I | Data 23 | |
| 36 | HSYNC | I | Horizontal Synchronous Signal | |
| 37 | VSYNC | I | Vertical Synchronous Signal | |
| 38 | DOTCLK | I | Data Clock | |
| 39 | NC | - | No Connect | |
| 40 | NC | - | No Connect | |
| 41 | VDD | P | power supply (3.3V) | |
| 42 | VDD | P | power supply (3.3V) | |
| 43 | NC | - | No Connect | |
| 44 | NC | - | No Connect | |
| 45 | NC | - | No Connect | |
| 46 | NC | - | No Connect | |
| 47 | NC(AUTODL) | - | No Connect (Auto-refresh function control pin.) | |
| 48 | NC(DISP) | - | No Connect (Sets the display mode.) | |
| 49 | NC(ENPROG) | - | No Connect (OTP program control pin.) | |
| 50 | NC | - | No Connect | |
| 51 | NC | - | No Connect | |
| 52 | DEN | I | Data enabling signal | |
| 53 | GND | P | Ground | |
| 54 | GND | P | Ground | |

Note2-1: I/O definition:

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

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

GND=0V

| Item | Symbol | Min | Max | Unit | Remark |
|------------------------------|---|------|---------|------------------|---------------------------------------|
| Power Supply Voltage | VDD | -0.3 | 4.0 | V | |
| Logic Input Signal Voltage | R7~R2,G7~G2, B7~B2,RESET SPENA,SPCK SPDA,HSYNC | -0.3 | VDD+0.3 | V | Including I/O overshoot voltage |
| Back Light Forward Current | I _{LED} | -- | 20 | mA | For each LED |
| Operating Temperature | T _{OPR} | -20 | 70 | °C | |
| Storage Temperature | T _{STG} | -30 | 80 | °C | |
| Relative Humidity (Note1) | RH | -- | ≤95 | % | Ta≤40°C |
| | | -- | ≤85 | % | 40°C<Ta≤50°C |
| | | -- | ≤55 | % | 50°C<Ta≤60°C |
| | | -- | ≤36 | % | 60°C<Ta≤70°C |
| | | -- | ≤24 | % | 70°C<Ta≤80°C |
| Absolute Humidity | AH | -- | ≤70 | g/m ³ | Ta>70°C |

Note1: Ta means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.

Condensation on the module is not allowed.

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|-----------------------------------|-------------------|-----|---------|-----|---------|--------|
| Power Supply Voltage | VDD | 3.2 | 3.3 | 3.4 | V | |
| Input Signal Voltage | Low Level | VIL | GND | -- | 0.3*VDD | V |
| | High Level | VIH | 0.7*VDD | -- | VDD | V |
| (Panel+ LSI) Power Consumption | Black Mode (60Hz) | -- | TBD | -- | mW | |
| | Standby Mode | -- | TBD | -- | mW | |

4.2 Driving Backlight

Ta=25°C

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---------------------|-----------------|-------|-------|-----|------|--------|
| Forward Current | I _F | -- | 20 | -- | mA | |
| Forward Voltage | V _F | -- | 18 | -- | V | |
| Power Consumption | W _{BL} | | TBD | | mW | |
| Operating Life Time | -- | 10000 | 20000 | -- | Hrs | |

Note 1: The figure below shows the connection of backlight LED.



Note 2: Each LED : I=20 mA, V =3V

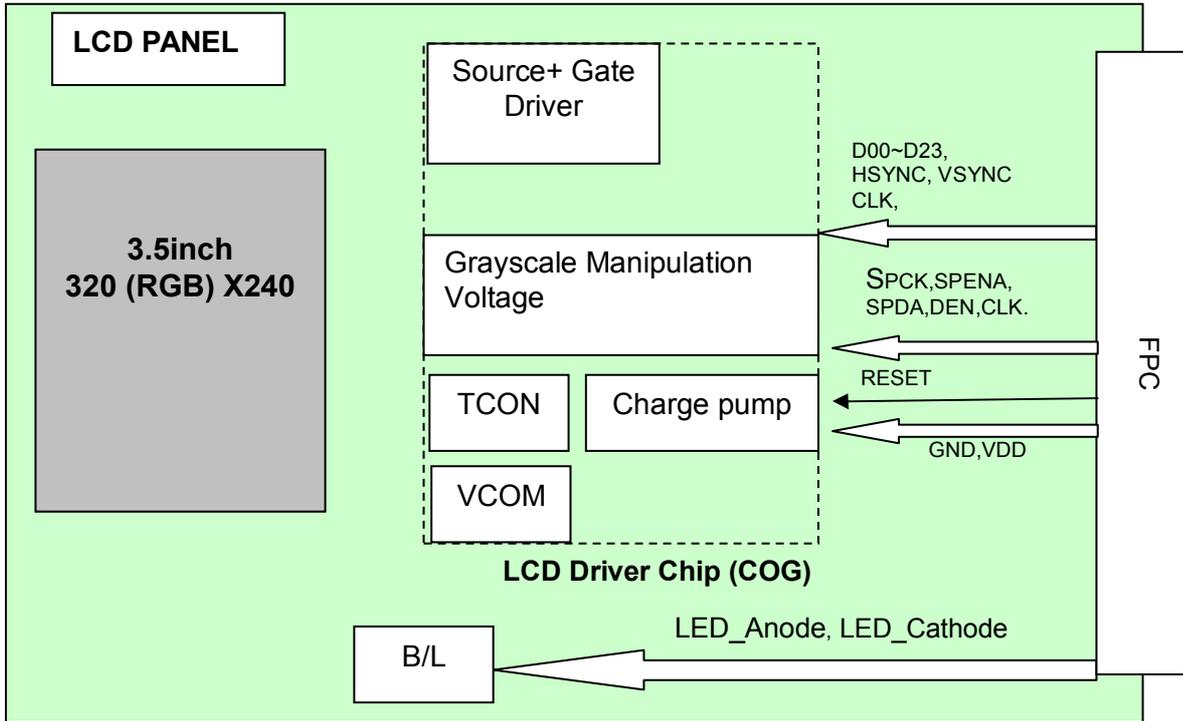
Note 3: IF is defined for one channel LED.

Optical performance should be evaluated at Ta=25°C only.

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.

4.3 Block Diagram



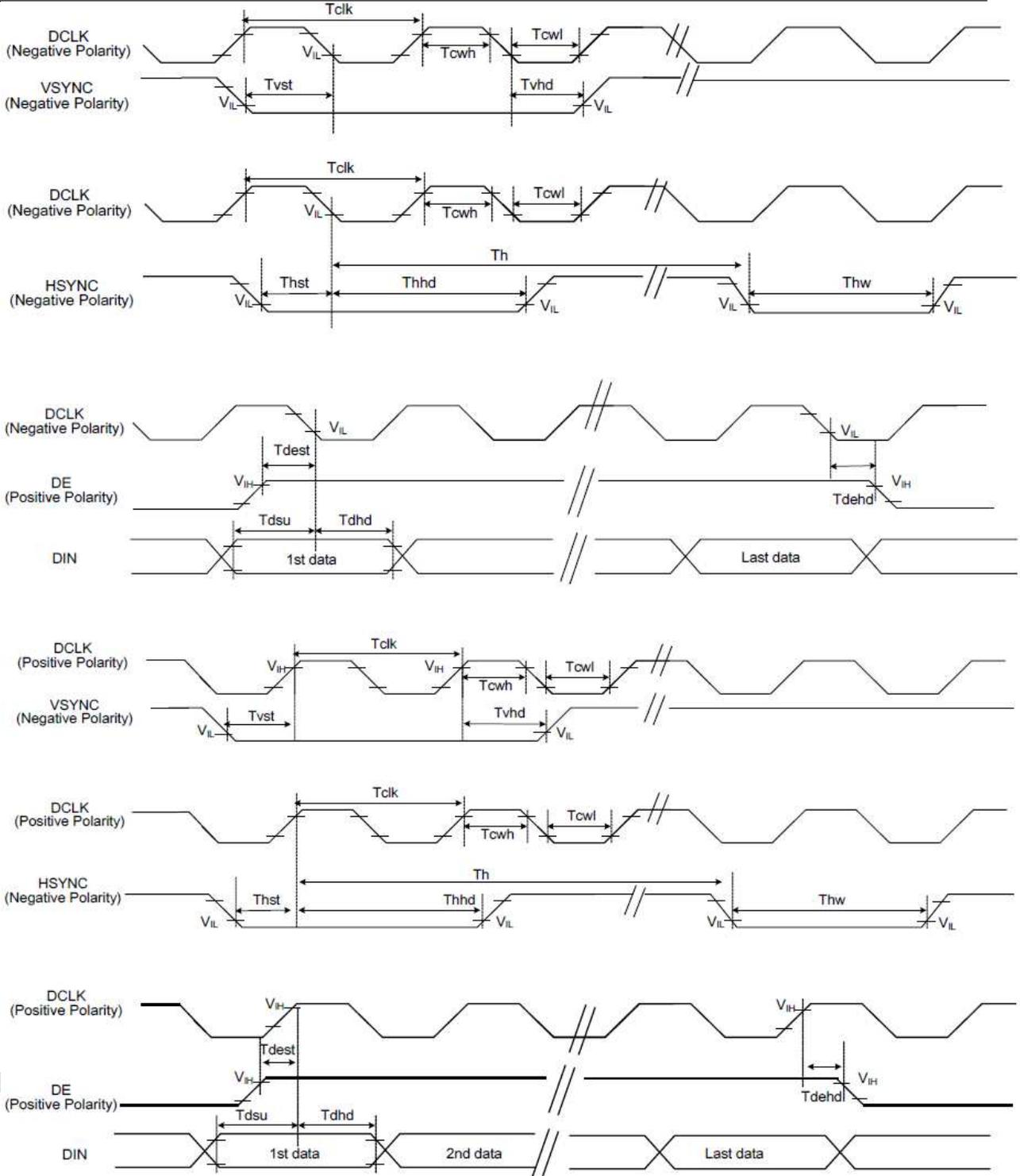
5 Timing Chart

5.1 24 bit RGB mode Input timing

5.1.1 RGB interface characteristics

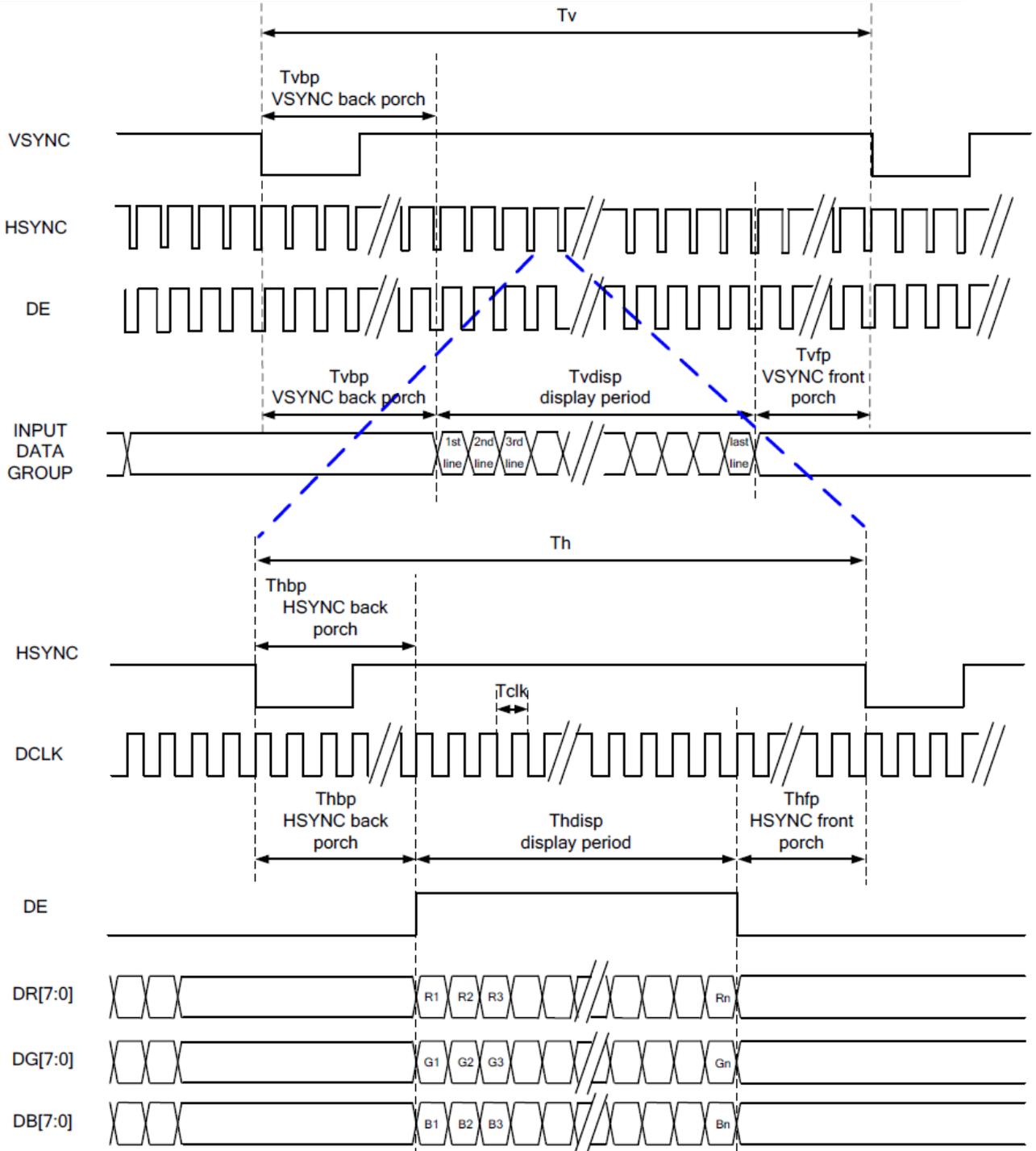
(VDD=3.3V, GND= 0V, Ta=25°C)

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|------------------|------------|-----|-----|-----|------|-----------|
| CLK Pulse Duty | T_{clk} | 40 | 50 | 60 | % | |
| HSYNC Width | T_{hw} | 2 | -- | -- | DCLK | |
| VSYNC Setup Time | T_{vst} | 12 | -- | -- | ns | |
| VSYNC Hold Time | T_{vhd} | 12 | -- | -- | ns | |
| HSYNC Setup Time | T_{hst} | 12 | -- | -- | ns | |
| HSYNC Hold Time | T_{hhd} | 12 | -- | -- | ns | |
| Data Setup Time | T_{dsu} | 12 | -- | -- | ns | |
| Data Hold Time | T_{dhd} | 12 | -- | -- | ns | |
| DE Setup Time | T_{dest} | 12 | -- | -- | ns | |
| DE Hold Time | T_{dehd} | 12 | -- | -- | ns | |



5.1.2 System Bus Timing for RGB Interface
(VDD=3.3V, GND= 0V,Ta=25°C)

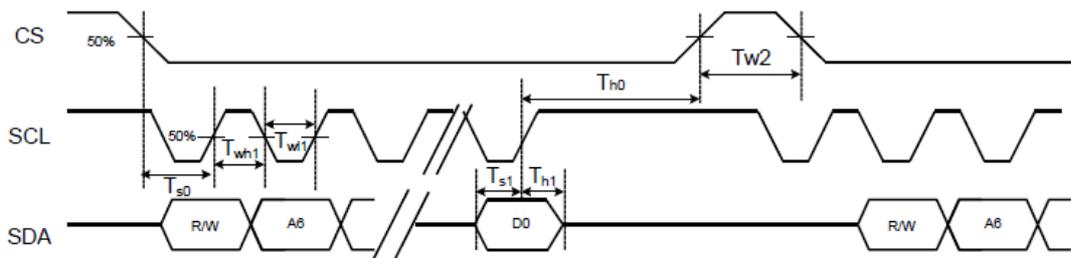
| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|----------------|----------------|--------|-----|-----|------|-----------|
| DCLK Frequency | Fclk | 5 | 6 | 8 | MHz | |
| DCLK Period | Tclk | 125 | 167 | 200 | ns | |
| HSYNC | Period Time | Th | 325 | 371 | 438 | DCLK |
| | Display Period | Thdisp | | 320 | | DCLK |
| | Back Porch | Thbp | 3 | 43 | 43 | DCLK |
| | Front Porch | Thfp | 2 | 8 | 75 | DCLK |
| | Pulse Width | Thw | 2 | 4 | 43 | DCLK |
| VSYNC | Period Time | Tv | 244 | 260 | 289 | HSYNC |
| | Display Period | Tvdisp | | 240 | | HSYNC |
| | Back Porch | Tvbp | 2 | 12 | 12 | HSYNC |
| | Front Porch | Tvfp | 2 | 8 | 37 | HSYNC |
| | Pulse Width | Tvw | 2 | 4 | 12 | HSYNC |



5.2 3-Wire SPI Interface Input timing

5.2.1 3-Wire SPI Interface characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|------------------------------|-----------|-----|-----|-----|------|--------|
| CS Input Setup Time | T_{s0} | 50 | -- | -- | ns | |
| Serial Data Input Setup Time | T_{s1} | 50 | -- | -- | ns | |
| CS Input Hold Time | T_{h0} | 50 | -- | -- | ns | |
| Serial Data Input Hold Time | T_{h1} | 50 | -- | -- | ns | |
| SCL Write Pulse High Width | T_{wh1} | 50 | -- | -- | ns | |
| SCL Write Pulse Low Width | T_{wl1} | 50 | -- | -- | ns | |
| SCL Read Pulse High Width | T_{rh1} | 300 | -- | -- | ns | |
| SCL Read Pulse Low Width | T_{rl1} | 300 | -- | -- | ns | |
| CS Pulse High Width | T_{w2} | 400 | | | ns | |



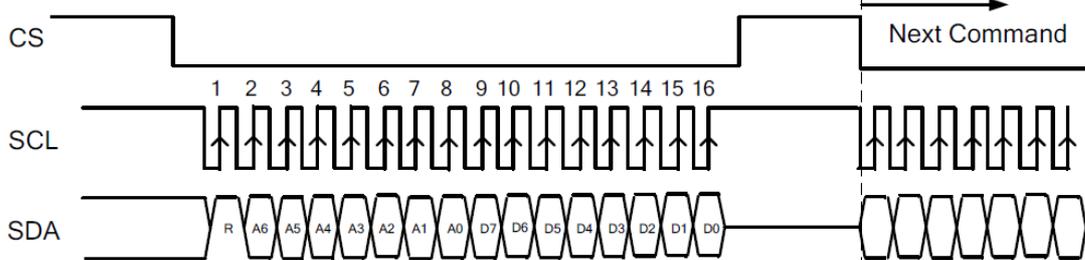
5.2.2 3-Wire SPI interface protocol

R/W: Read/Write mode control bit.

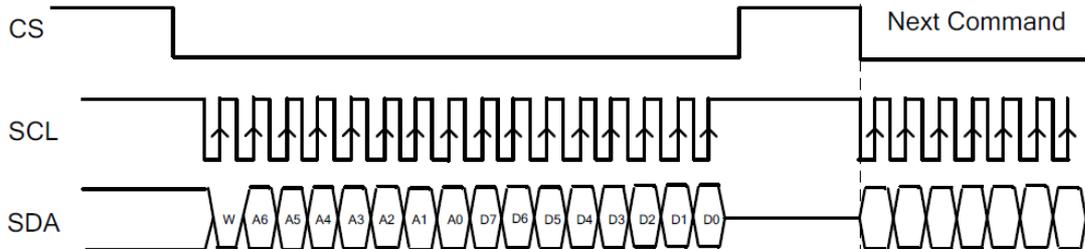
R/W=1: Read mode

R/W=0: Write mode

Read Mode

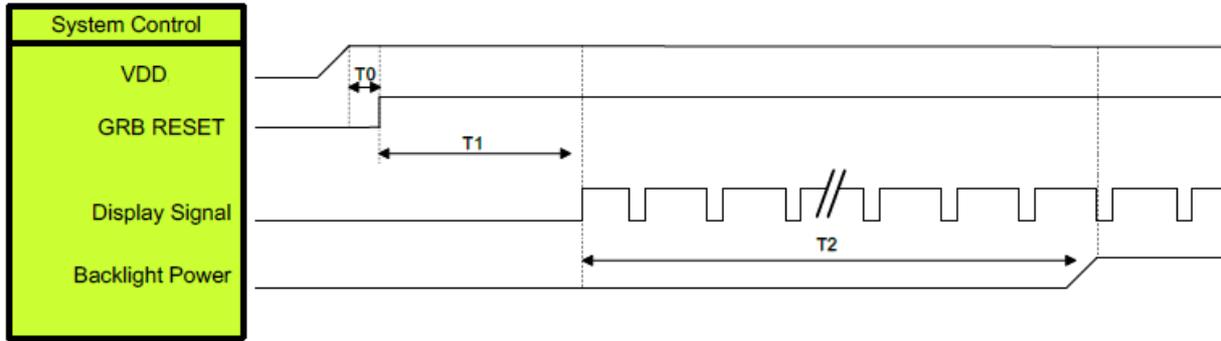


Write Mode



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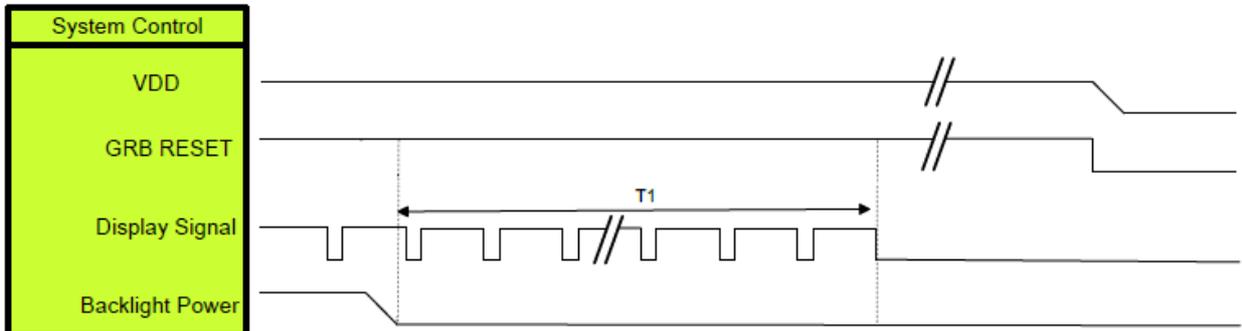
5.3 Power On Sequence



| Symbol | Description | Min. Time | Unit |
|--------|---|-----------|------|
| T0 | System power stability to GRB RESET signal | 0 | ms |
| T1 | GRB RESET= "High" to Display Signal output | 10 | ms |
| T2 | Display Signal output to Backlight Power on | 250 | ms |

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

5.4 Power off Sequence



| Symbol | Description | Min. Time | Unit |
|--------|---|-----------|------|
| T1 | Backlight Power off to IC internal voltage discharge complete | 80 | ms |

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

6 Optical Characteristics

6.1 Optical Specification

Ta=25°C

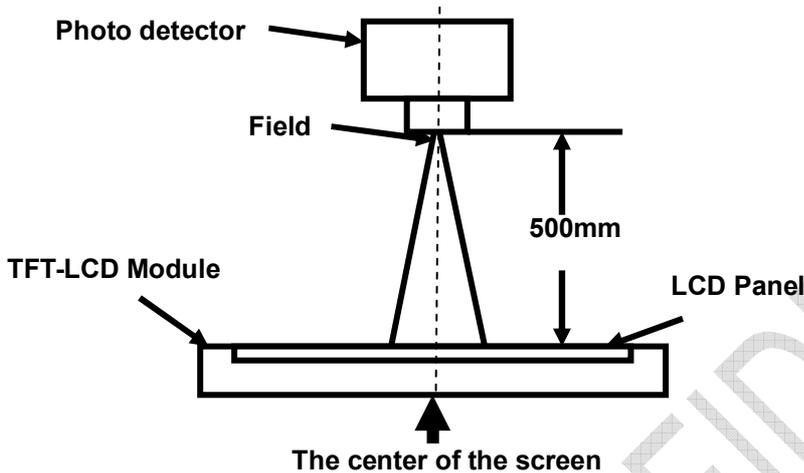
| Item | Symbol | Condition | Min | Typ. | Max. | Unit | Remark |
|----------------|------------|------------------|-------|-------|-------|-------------------|-----------------|
| View Angles | θT | $CR \geq 10$ | 70 | 80 | -- | Degree | Note 2 |
| | θB | | 70 | 80 | -- | | |
| | θL | | 70 | 80 | -- | | |
| | θR | | 70 | 80 | -- | | |
| Contrast Ratio | CR | $\theta=0^\circ$ | 600 | 800 | -- | | Note1 Note3 |
| Response Time | T_{ON} | 25°C | -- | 25 | 35 | ms | Note1 Note4 |
| | T_{OFF} | | | | | | |
| Chromaticity | White | x | 0.263 | 0.313 | 0.363 | | Note5, Note1 |
| | | y | 0.287 | 0.337 | 0.387 | | |
| | Red | x | 0.578 | 0.628 | 0.678 | | |
| | | y | 0.306 | 0.356 | 0.406 | | |
| | Green | x | 0.293 | 0.343 | 0.393 | | |
| | | y | 0.537 | 0.587 | 0.637 | | |
| | Blue | x | 0.097 | 0.147 | 0.197 | | |
| | | y | 0.040 | 0.090 | 0.140 | | |
| Uniformity | U | | 75 | 80 | -- | % | Note1 Note6 |
| NTSC | | | 55 | 60 | -- | % | Note 5 |
| Luminance | L | | 300 | 350 | -- | cd/m ² | Note1 Note7 |

Test Conditions:

1. $V_F = 3V$, $I_F = 20mA$ (LED current), the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note2.

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.



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

viewing angle is measured at the center point of the LCD by EZ-Contrast.

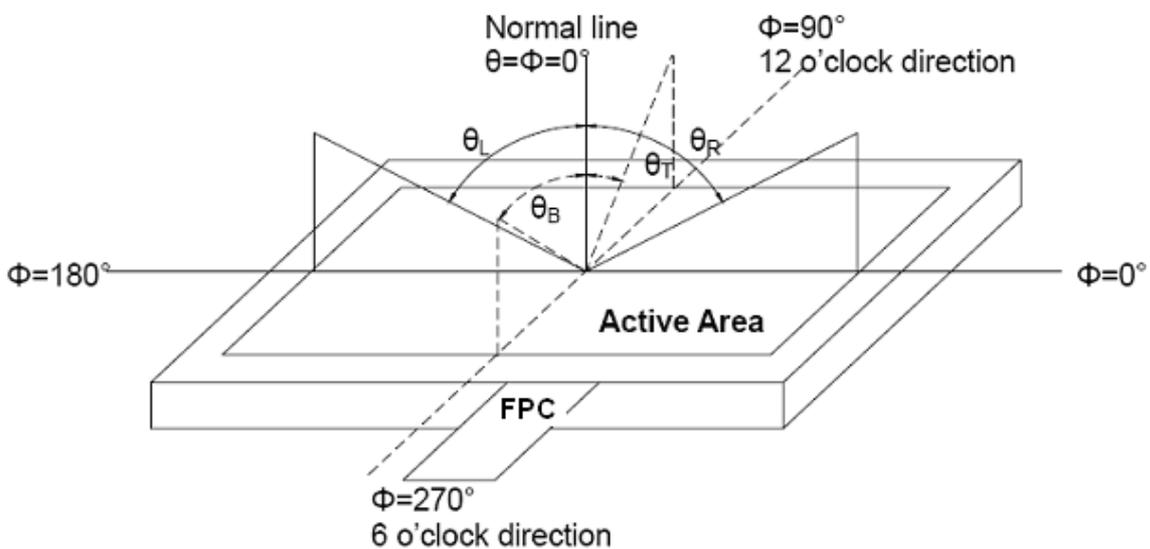


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

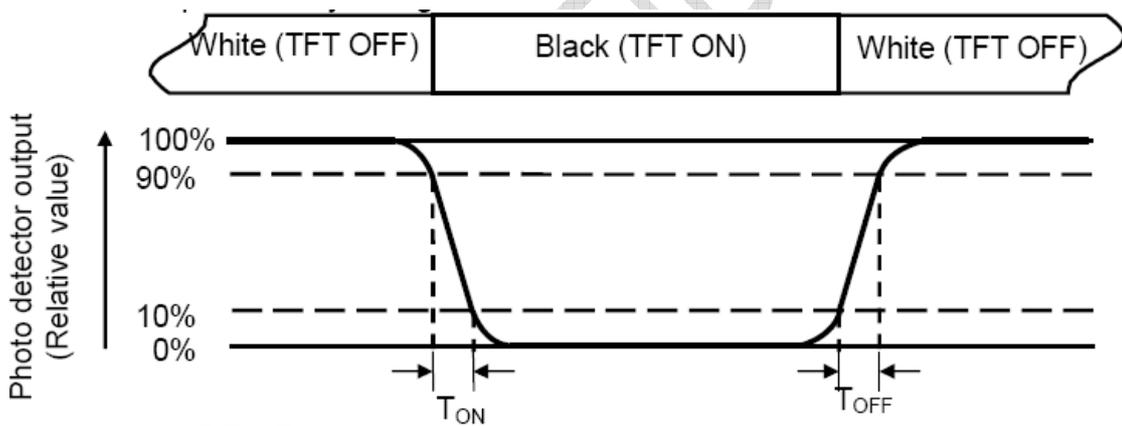
“White state “:The state is that the LCD should driven by Vwhite.

“Black state”: The state is that the LCD should driven by Vblack.

Vwhite: To be determined Vblack: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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.

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

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

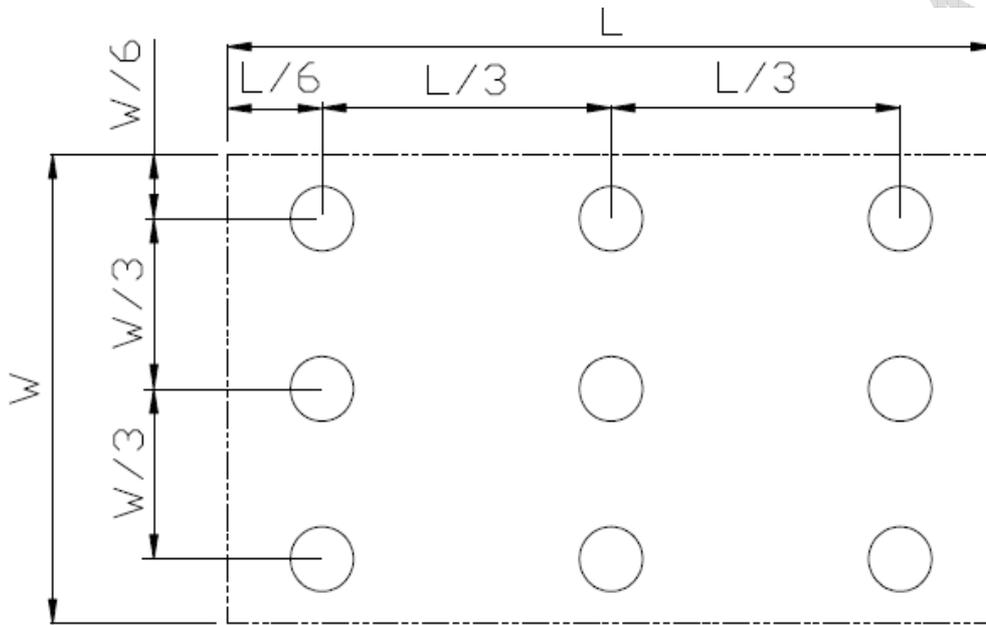


Fig. 2 Definition of uniformity

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 Tests

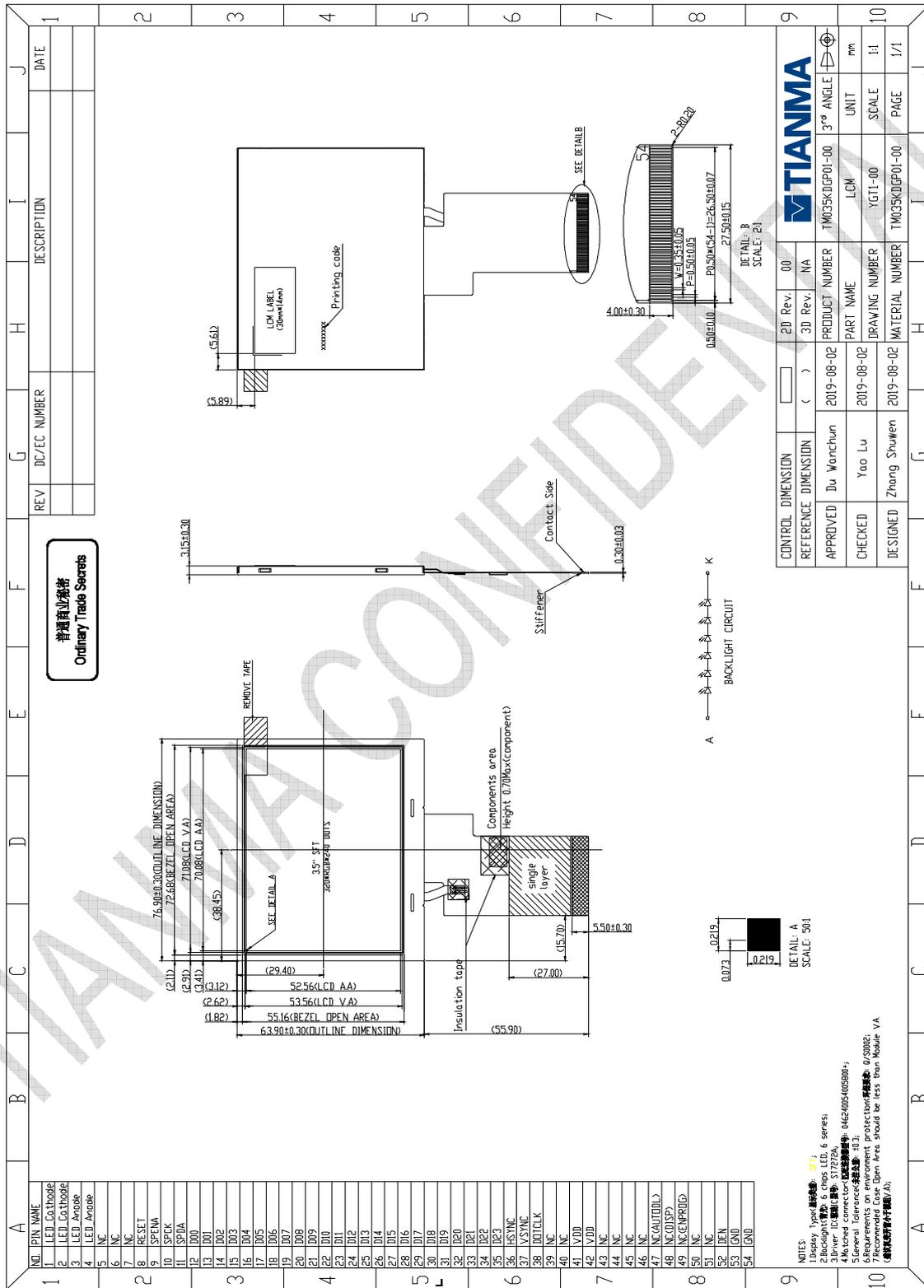
| No | Test Item | Condition | Remarks |
|----|---|--|---|
| 1 | High Temperature Operation | Ta=+70°C, 240hrs | IEC60068-2-1:2007,GB2423.2-2008 |
| 2 | Low Temperature Operation | Ta=-20°C, 240hrs | IEC60068-2-1:2007 GB2423.1-2008 |
| 3 | High Temperature Storage | Ta=+80°C, 240hrs | IEC60068-2-1:2007 GB2423.2-2008 |
| 4 | Low Temperature Storage | Ta=-30°C, 240hrs | IEC60068-2-1:2007 GB2423.1-2008 |
| 5 | Temperature & Humidity | Ta=60°C, 90% RH 240 hours | IEC60068-2-78 :2001 GB/T2423.3-2006 |
| 6 | Thermal Shock (Non-operation) | -30°C 30 min~+80°C 30 min, Change time:5min, 100 Cycles | Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2012 |
| 7 | Electro Static Discharge (Operation) | C=150pF, R=330Ω·5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15°C~35°C, 30%~60%, 86Kpa~106Kpa) | IEC61000-4-2:2001 GB/T17626.2-2006 |
| 8 | Vibration (Non-operation) | Frequency range : 10~55Hz Stroke : 1.5mm Sweep : 10Hz~55Hz~10Hz 2h for x,y,z (total 6h) | IEC60068-2-6:1982 GB/T2423.10-2008 |
| 9 | Shock (Non-operation) | Half Sine Wave 60G ,6ms,±X,±Y,±Z 3times for each direction | IEC60068-2-27:1987 GB/T2423.5-1995 |
| 10 | Package Drop Test | Height: TBD cm, 1 corner, 3 edges, 6 surfaces | GB/T 4857.5-1992 |

Note1: Ta is the ambient temperature of sample.

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

8 Mechanical Drawing

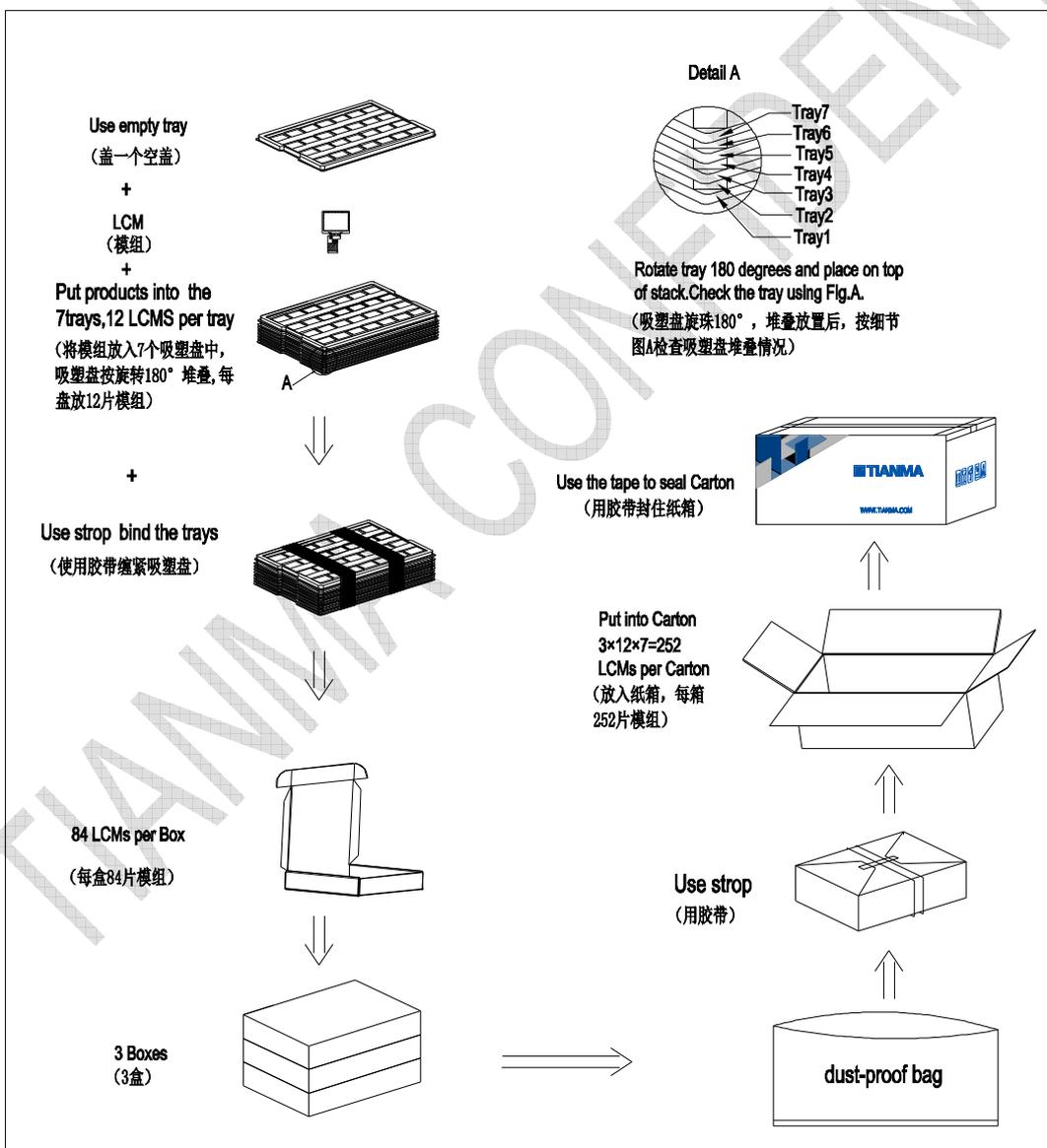


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9 Packing drawing

| No | Item | Model (Material) | Dimensions(mm) | Unit Weight(Kg) | Quantity | Remark |
|----|----------------|------------------|------------------|-----------------|----------|--------|
| 1 | LCM module | TM035KDGP01-00 | 76.90×63.90×3.15 | TBD | 252 | |
| 2 | Dust-Proof Bag | PE | 235×150×0.05mm | TBD | 1 | |
| 3 | Tray | PET | 485×330×13.8 | TBD | 24 | |
| 4 | Carton | Corrugated Paper | 544×365×250 | TBD | 1 | |
| 5 | BOX | Corrugated Paper | 520×345×74 | TBD | 3 | |
| 6 | Label | Paper | 100*52 | TBD | 1 | |
| 7 | Total weight | TBD ± 5%Kg | | | | |

Total LCM quantity in Carton: quantity per tray 12 × 21 tray = 252



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纸箱堆叠数按 2*3/每层*共 5 层



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

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