**MODEL NO   :**      TM070RDH13

**MODEL VERSION:**      40

**SPEC VERSION :**      2.8

**ISSUED DATE:**      2015-12-30

□**Preliminary Specification**
■**Final Product Specification**

**Customer :**_____

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

**TIANMA Confirmed :**

| Prepared by | Checked by | Approved by |
|---|---|---|
| Junwen Du | Longping Deng | Feng Qin |

This technical specification is subjected to change without notice

# Table of Contents

# Record of Revision

| Rev | Issued Date | Description | Editor |
|-----|-------------|-------------|--------|
| 2.0 | 2014.10.21 | Final specification release | Yuelong Zhou |
| 2.1 | 2014.12.10 | Modify the optical characteristics | Yuelong Zhou |
| 2.2 | 2015.03.31 | Modify the interface define | Yuelong Zhou |
| 2.3 | 2015.05.15 | Details modified | Yuelong Zhou |
| 2.4 | 2015.07.20 | Update the power consumption | Rui Xu |
| 2.5 | 2015.07.22 | Update the power on/off sequence | Rui Xu |
| 2.6 | 2015.08.03 | Update the absolute Maximum Ratings and electrical Characteristics | Rui Xu |
| 2.7 | 2015.10.13 | Update the   electrical Characteristics | Longping.Deng |
| 2.8 | 2015.12.30 | Add the absolute maximum ratings | Junwen Du |
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# 1 General Specifications

| Feature | | Spec |
|---|---|---|
| **Display Spec.** | Size | 7 inch |
| | Resolution | 800(RGB) x 480 |
| | Technology Type | a-Si |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Pixel pitch(mm) | 0.1926 (H) x 0.1790(V) |
| | Display Mode | TM with Normally White |
| | Surface Treatment | Anti Glare |
| | Viewing Direction | 12 o'clock |
| | Gray Scale Inversion Direction | 6 o'clock |
| **Mechanical Characteristics** | LCM (W x H x D) (mm) | 164.9x 100.0 x 5.7 |
| | Active Area(mm) | 154.08 (W) x 85.92 (H) |
| | With /Without TSP | Without TSP |
| | Matching Connection Type | FH12A-50S-0.5H |
| | LED Numbers | 18 LEDs |
| | Weight (g) | 160 g |
| **Electrical Characteristics** | Interface | RGB 24 bits with TCON |
| | Color Depth | 16.7M |
| | Driver IC | HX8264-D0+HX8664-B0 |

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: ± 5%

# 2 Input/Output Terminals

## 2.1 CN1 of FPC

Matched connector type: FH12A-50S-0.5H

| Pin No. | Symbol | I/O | Function | Remark |
|---|---|---|---|---|
| 1 | VLED+ | P | Power for LED backlight(anode) | |
| 2 | VLED+ | P | Power for LED backlight(anode) | |
| 3 | VLED- | P | Power for LED backlight(Cathode) | |
| 4 | VLED- | P | Power for LED backlight(Cathode) | |
| 5 | GND | P | Power ground | |
| 6 | NC | N | No connection | |
| 7 | DVDD | P | Power for digital circuit | |
| 8 | MODE | I | DE/SYNC mode select. Normally pull high | MODE=1,DE mode, VS and HS must pull high; MODE=0, HSD/VSD mode, DE must be grounded |
| 9 | DE | I | Data input enable | |
| 10 | VS | I | Vertical Sync Input | |
| 11 | HS | I | Horizontal Sync Input | |
| 12 | B7 | I | Blue data(MSB) | |
| 13 | B6 | I | Blue data | |
| 14 | B5 | I | Blue data | |
| 15 | B4 | I | Blue data | |
| 16 | B3 | I | Blue data | |
| 17 | B2 | I | Blue data | |
| 18 | B1 | I | Blue data | When input 18 bits RGB data, B1 must be grounded |
| 19 | B0 | I | Blue data(LSB) | When input 18 bits RGB data, B0 must be grounded |
| 20 | G7 | I | Green data(MSB) | |
| 21 | G6 | I | Green data | |
| 22 | G5 | I | Green data | |
| 23 | G4 | I | Green data | |
| 24 | G3 | I | Green data | |
| 25 | G2 | I | Green data | |
| 26 | G1 | I | Green data | When input 18 bits RGB data, G1 must be grounded |
| 27 | G0 | I | Green data(LSB) | When input 18 bits RGB data, G0 must be grounded |
| 28 | R7 | I | RED data(MSB) | |
| 29 | R6 | I | RED data | |
| 30 | R5 | I | RED data | |
| 31 | R4 | I | RED data | |
| 32 | R3 | I | RED data | |
| 33 | R2 | I | RED data | |
| 34 | R1 | I | RED data | When input 18 bits RGB data, R1 must be grounded |
| 35 | R0 | I | RED data(LSB) | When input 18 bits RGB data, R0 must be grounded |

| 36 | GND | P | Power ground | |
|---|---|---|---|---|
| 37 | DCLK | I | Sample clock | Data shall be latched at the falling edge of DCLK |
| 38 | GND | I | Power ground | |
| 39 | L/R | I | Left/right selection | Selection of scanning mode |
| 40 | U/D | I | Up/down selection | Selection of scanning mode |
| 41 | VGH | P | Gate on voltage | |
| 42 | VGL | P | Gate off voltage | |
| 43 | AVDD | P | Power for analog circuit | |
| 44 | RESET | I | Global reset pin | Active low to enter reset state, suggest to connect with an RC reset circuit for stability. Normally pull high |
| 45 | NC | N | No connection | |
| 46 | NC | N | No connection | |
| 47 | DITHB | I | Dithering function enable control, normally pull high; | When DITHB=1,disable internal dithering function; When DITHB=0, enable internal dithering function; |
| 48 | GND | P | Power ground | |
| 49 | NC | N | No connection | |
| 50 | NC | N | No connection | |

Note1：Please add the FPC connector type and matched one if necessary .

Note2：I——Input, O——Output, P——Power/Ground, N--- No Connection

### 2.2 U/D R/L Function Description

| 3 Scan Control Input | | Scanning Direction |
|---|---|---|
| UPDN | SHLR | |
| GND | DVDD | Up to Down, Left to Right |
| DVDD | GND | Down to Up, Right to Left |
| GND | GND | Up to Down, Right to Left |
| DVDD | DVDD | Down to Up, Left to Right |

# 3 Absolute Maximum Ratings

GND=0V

| Item | Symbol | MIN | MAX | Unit | Remark |
|---|---|---|---|---|---|
| Power Voltage | VCC | -0.5 | 5.0 | V | Note1 |
| Input voltage | $V_{IN}$ | -0.5 | 5.0 | V | Note1 |
| Operating Temperature | Top | -20 | 70 | ℃ | |
| Storage Temperature | Tst | -30 | 80 | ℃ | |
| Relative Humidity Note2 | RH | -- | ≤95 | % | Ta≤40℃ |
| | | -- | ≤85 | % | 40℃＜Ta≤50℃ |
| | | -- | ≤55 | % | 50℃＜Ta≤60℃ |
| | | -- | ≤36 | % | 60℃＜Ta≤70℃ |
| | | -- | ≤24 | % | 70℃＜Ta≤80℃ |
| Absolute Humidity | AH | -- | ≤70 | g/m³ | Ta＞70℃ |

**Table 3　Absolute Maximum Ratings**

Note1: Input voltage include R0~R7, G0~G7, B0~B7, DCIK, Hsync, Vsync, DE

Note2: 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

AGND=GND=0V, Ta = 25℃

| Item | | Symbol | MIN | TYP | MAX | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Digital supply Voltage | | VCC | 3.00 | 3.30 | 3.60 | V | |
| Analog supply Voltage | | AVDD | 10.1 | 10.4 | 10.7 | V | |
| Gate on voltage | | VGH | 14.4 | 16 | 17.6 | V | |
| Gate off voltage | | VGL | -7.70 | -7.00 | -6.30 | V | |
| Input Signal Voltage | Low Level | $V_{IL}$ | 0 | - | 0.3xVCC | V | R0~R7,G0~G7,0~B7,DE, DCLK,HSYNC,VSYNC,MODE, RESET,LR,UD, DITHB |
| | High Level | $V_{IH}$ | 0.7xVCC | - | VCC | V | |
| Current of digital supply voltage | | $I_{VCC}$ | - | - | 10 | mA | VCC=3.3V,colorbar pattern |
| Current of analog supply voltage | | $I_{AVDD}$ | - | - | 30 | mA | |
| Current of Gate on voltage | | $I_{VGH}$ | - | - | 0.3 | mA | VGH=16.0V |
| Current of Gate off voltage | | $I_{VGL}$ | - | - | 0.3 | mA | VGL=-7.0V |

Note: The value is for design stage only.

### 4.2 Recommended Driving Condition for Backlight

Ta=25℃

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|------|--------|-----|-----|-----|------|--------|
| Forward Current | $I_F$ | - | 120 | 180 | mA | 18 LEDs (3 LED Serial, 6 LED Parallel) |
| Forward Voltage | $V_F$ | 9 | 9.6 | 10.8 | V | |
| Operating Life Time | - | 20,000 | - | - | Hrs | |

Note1: The LED driving condition is defined for each module (3 LED Serial, 6 LED Parallel).

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: $I_F$ is defined for six channel LED. Optical performance should be evaluated at Ta=25℃, When 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.

Note4: The LED driving condition is defined for each LED module.
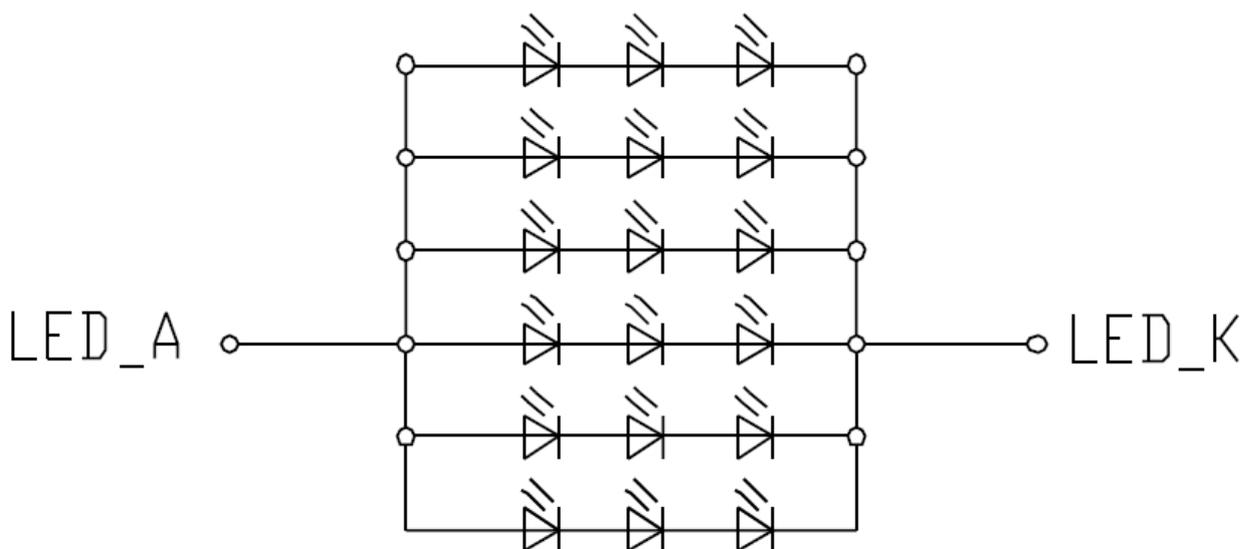


LED circuit

## 4.3 Block Diagram



LCD Panel
7.0 inch
800(RGB)X480

Gate driver IC

Source driver IC
+
TCON

Back light

VGH,
VGL,
AVDD,
R[0:7]
G[0:7]
B[0:7]
VCOM
DVDD
GND
DITHB
L/R
U/D
MODE
HS,VS,DE,
DCLK
VLED+
VLED-
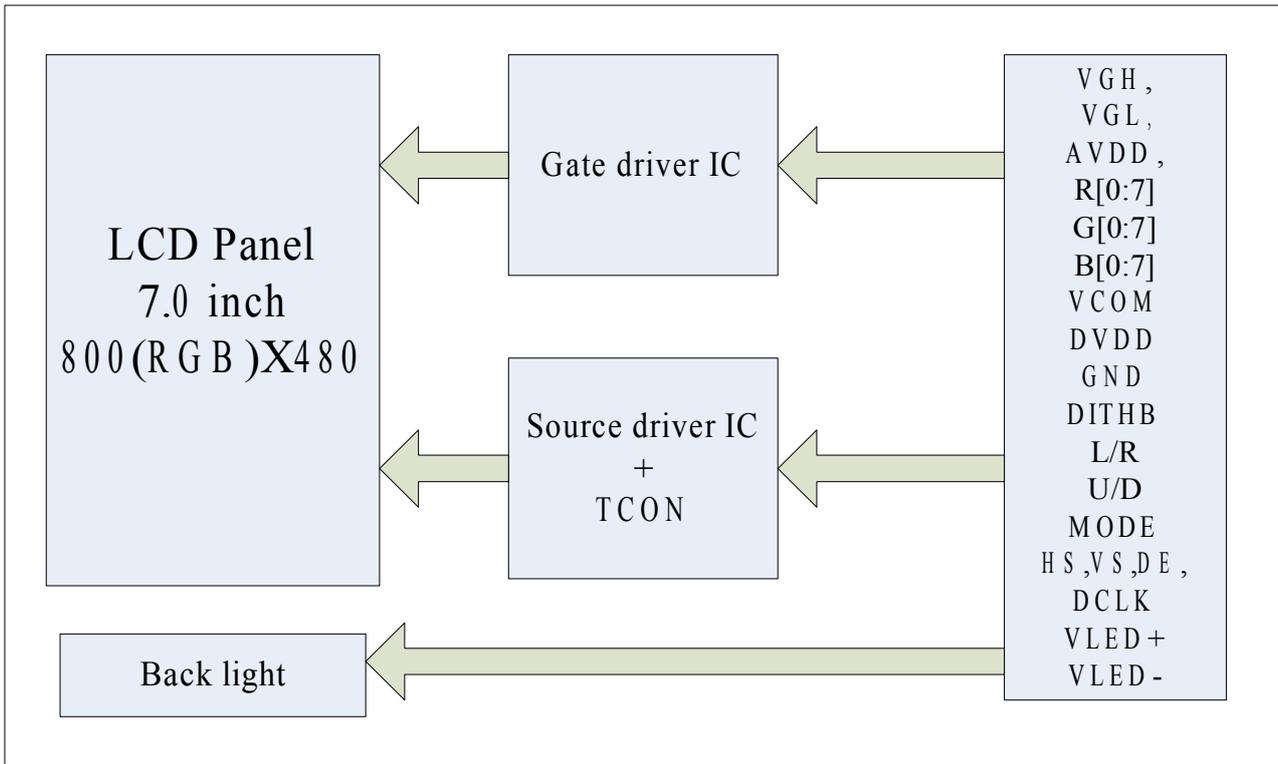
# 5 Timing Chart

## 5.1 TFT-LCD Input Timing

DVDD=3.3V, AVDD=10.4V, AGND=GND=0V, Ta=25℃

| Parameter | Symbol | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| DCLK Frequency | Fclk | - | 30.0 | 40.0 | MHz | |
| DCLK Cycle Time | Tcph | 25.0 | 33.3 | - | ns | |
| DCLK Pulse Width | Tcw | 40% | 50% | 60% | Tcph | |
| VSD Setup Time | Tvst | 8 | - | - | ns | |
| VSD Hold Time | Tvhd | 8 | - | - | ns | |
| HSD Setup Time | Thst | 8 | - | - | ns | |
| HSD Hold Time | Thhd | 8 | - | - | ns | |
| Data Setup Time | Tdsu | 8 | - | - | ns | Data to DCLK |
| Data Hold Time | Tdhd | 8 | - | - | ns | Data to DCLK |
| DE Setup Time | Tesu | 8 | - | - | ns | |
| DE Hold Time | Tehd | 8 | - | - | ns | |

**Input Clock and Data timing Diagram:**
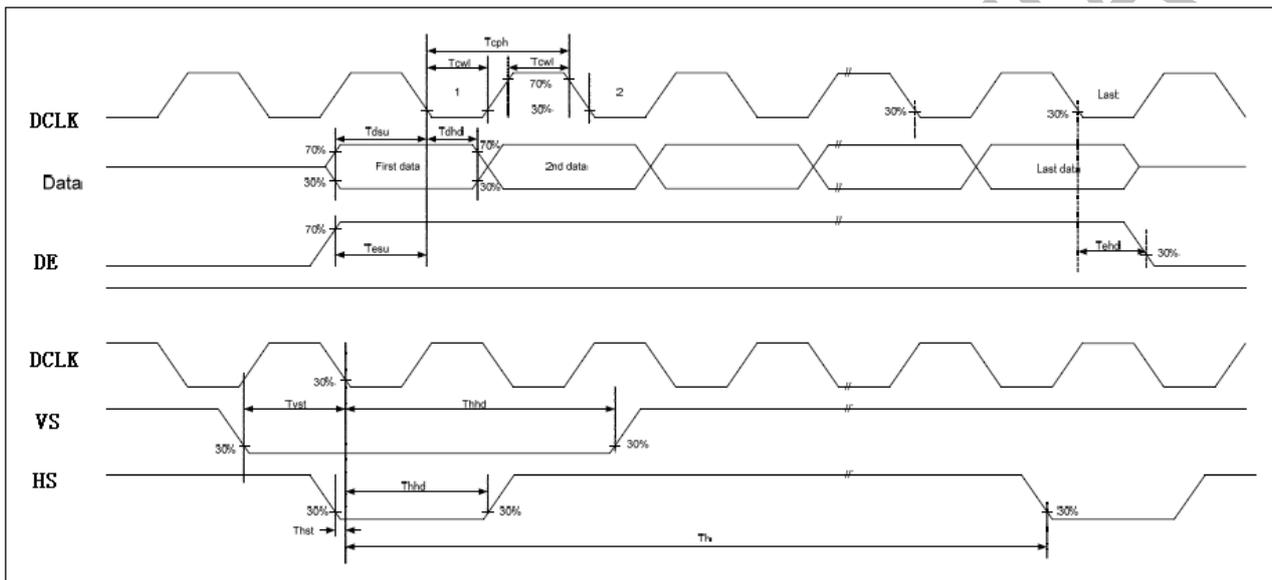
### 5.2 Recommended Timing Setting Of TCON

**TCON (Embedded In Source IC) Input Timing (DCLK, HSD, VSD, DE)**

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|-----------|--------|-----|-----|-----|------|--------|
| DCLK | $F_{clk}$ | - | 30 | 40 | MHZ | |
| | $t_{clk}$ | 25.0 | 33.3 | - | ns | |
| HSD | $t_h$ | 862 | 1056 | 1200 | $t_{clk}$ | |
| | $t_{hd}$ | - | 800 | - | $t_{clk}$ | |
| | $t_{hpw}$ | 1 | - | 40 | $t_{clk}$ | |
| | $t_{hb}$ | - | 46 | - | $t_{clk}$ | |
| | $t_{hfp}$ | 16 | 210 | 354 | $t_{clk}$ | |
| VSD | $t_v$ | 510 | 525 | 650 | $t_h$ | |
| | $t_{vd}$ | - | 480 | - | $t_h$ | |
| | $t_{vpw}$ | 1 | - | 20 | $t_h$ | |
| | $t_{vb}$ | - | 23 | - | $t_h$ | |
| | $t_{vfp}$ | 7 | 22 | 147 | $t_h$ | |

Note: DE timing refer to HSD, VSD input timing.

**Vertical input timing Diagram:**
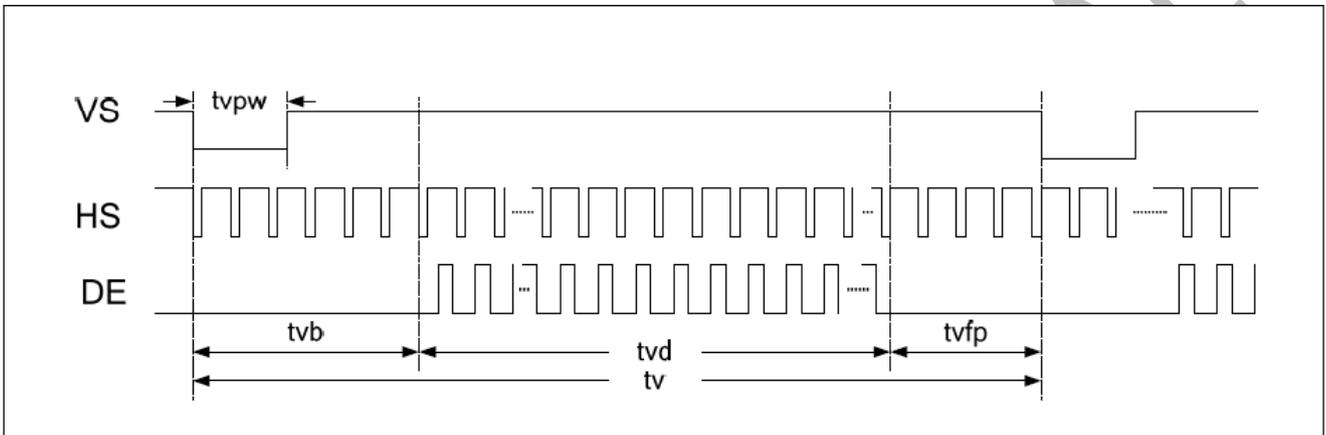
## TCON Horizontal Input Timing Diagram
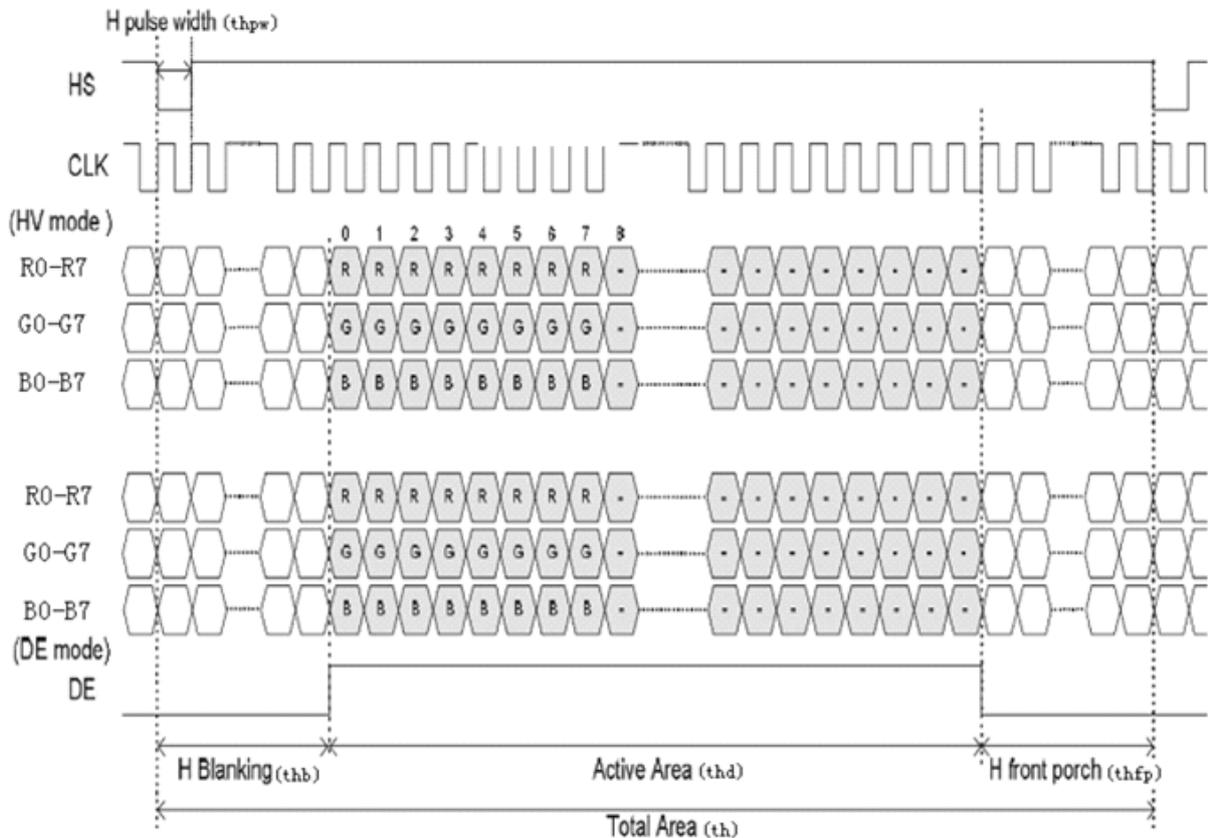


### 5.3 Power ON/OFF Sequence
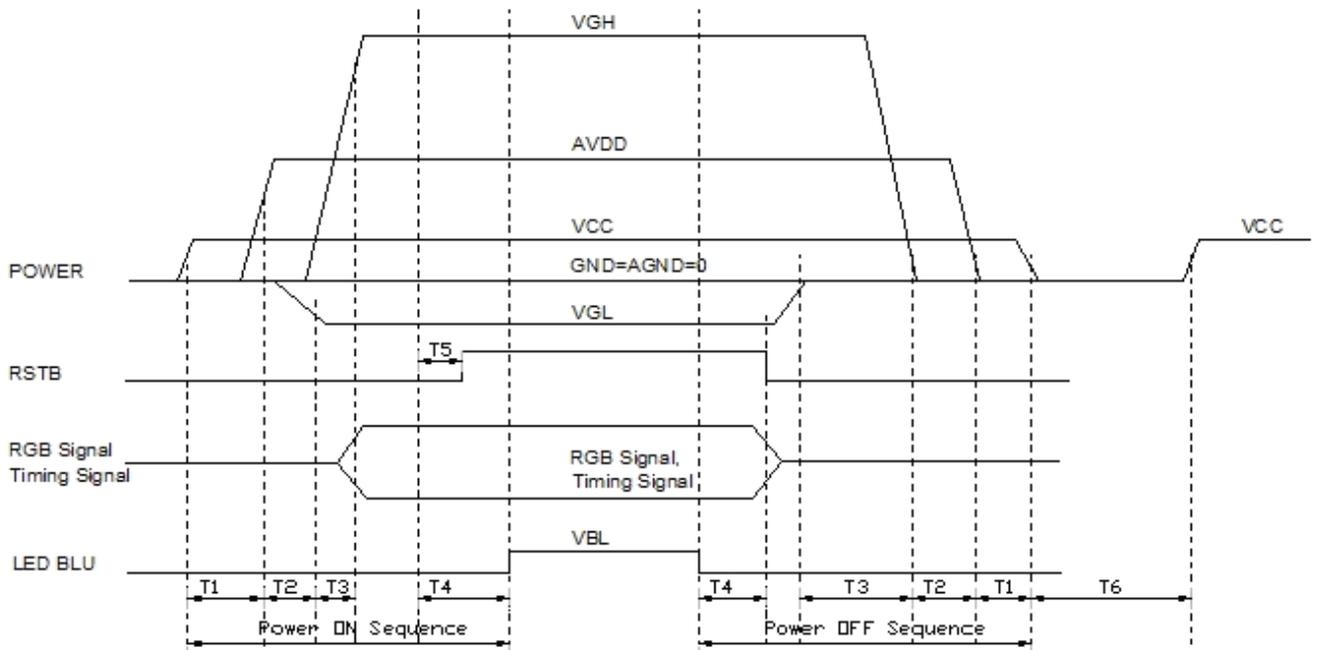


Note 1: T1≥20ms, T2≥20ms, T13≥5ms, T4≥100ms, T5≥5ms, T6≥1000ms.

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# 6 Optical Characteristics

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| **View Angles** | | θT | CR≧10 | 50 | 60 | | Degree | Note2,3 |
| | | θB | | 60 | 80 | | | |
| | | θL | | 60 | 80 | | | |
| | | θR | | 60 | 80 | | | |
| **Contrast Ratio** | | CR | θ=0° | 600 | 800 | | | Note 3 |
| **Response Time** | | $T_{ON}$ | 25℃ | - | 20 | 30 | ms | Note 4 |
| | | $T_{OFF}$ | | | | | | |
| **Chromaticity** | **White** | x | Backlight is on | 0.262 | 0.312 | 0.362 | | Note 1,5 |
| | | y | | 0.270 | 0.320 | 0.370 | | |
| | **Red** | x | | 0.535 | 0.585 | 0.635 | | Note 1,5 |
| | | y | | 0.301 | 0.351 | 0.401 | | |
| | **Green** | x | | 0.300 | 0.350 | 0.400 | | Note 1,5 |
| | | y | | 0.532 | 0.582 | 0.632 | | |
| | **Blue** | x | | 0.101 | 0.151 | 0.201 | | Note 1,5 |
| | | y | | 0.035 | 0.085 | 0.135 | | |
| **Uniformity** | | U | | 75 | 80 | - | % | Note 6 |
| **NTSC** | | | | - | 50 | - | % | Note 5 |
| **Luminance** | | L | | 250 | 300 | - | cd/m² | Note 7 |

Test Conditions:

1    $I_F$= 120 mA, and 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.
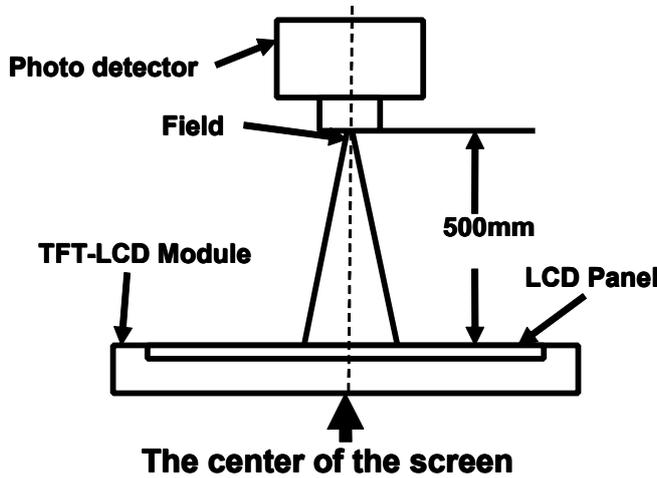


| Item | Photo detector | Field |
|---|---|---|
| Contrast Ratio | SR-3A | 1° |
| Luminance | | |
| Chromaticity | | |
| Lum Uniformity | | |
| Response Time | BM-7A | 2° |

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)。
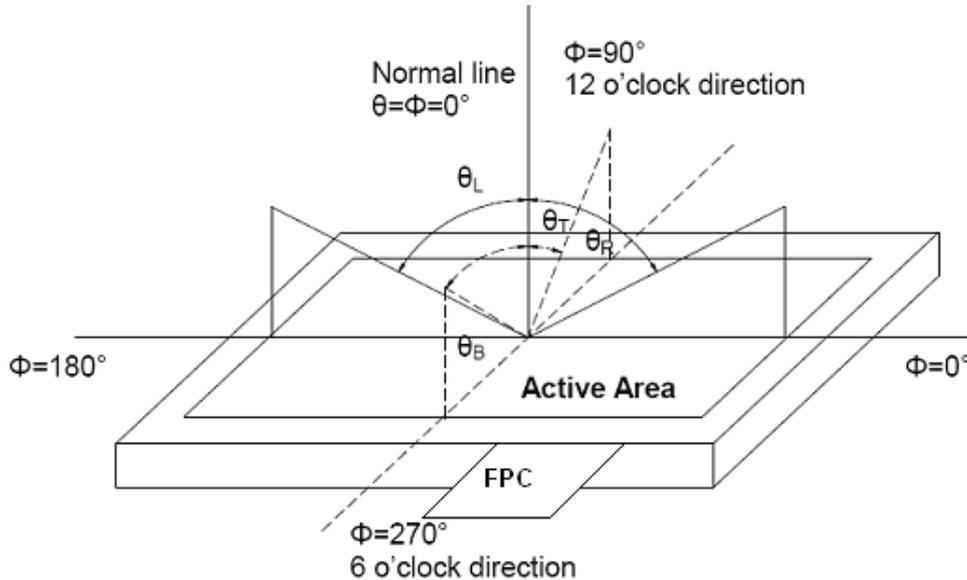


Note 3:   Definition of contrast ratio

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

"White state ": The state is that the LCD should drive by Vwhite.

"Black state": The state is that the LCD should drive 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 ($T_{ON}$) 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%.
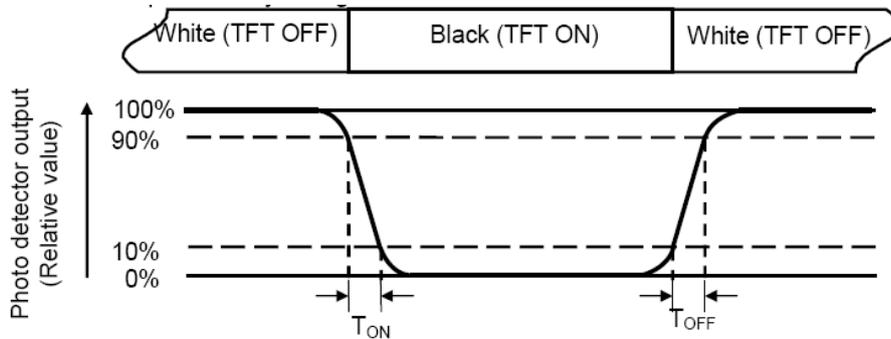

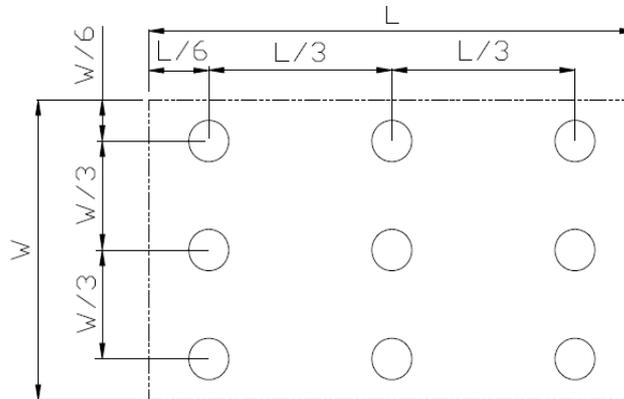
Note 5:   Definition of color chromaticity (CIE1931)

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) = Lmin/ Lmax

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



Lmax: The measured Maximum luminance of all measurement position.

Lmin: 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 = +70℃, 240 hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 2 | Low Temperature Operation | Ta = -20℃, 240 hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 3 | High Temperature Storage | Ta = +80℃, 240 hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 4 | Low Temperature Storage | Ta = -30℃, 240 hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 5 | Storage at High Temperature and Humidity | Ta = +60℃, 90% RH max,240hours | IEC60068-2-78 :2001 GB/T2423.3—2006 |
| 6 | Thermal Shock (non-operation) | -30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycle | Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002 |
| 7 | ESD | C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa) | IEC61000-4-2:2001 GB/T17626.2-2006 |
| 8 | Vibration Test | Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) | IEC60068-2-6:1982 GB/T2423.10—1995 |
| 9 | Mechanical Shock (Non OP) | 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:60cm, 1corner,3 edges,6 surfaces | IEC60068-2-32:1990 GB/T2423.8—1995 |

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

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: 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
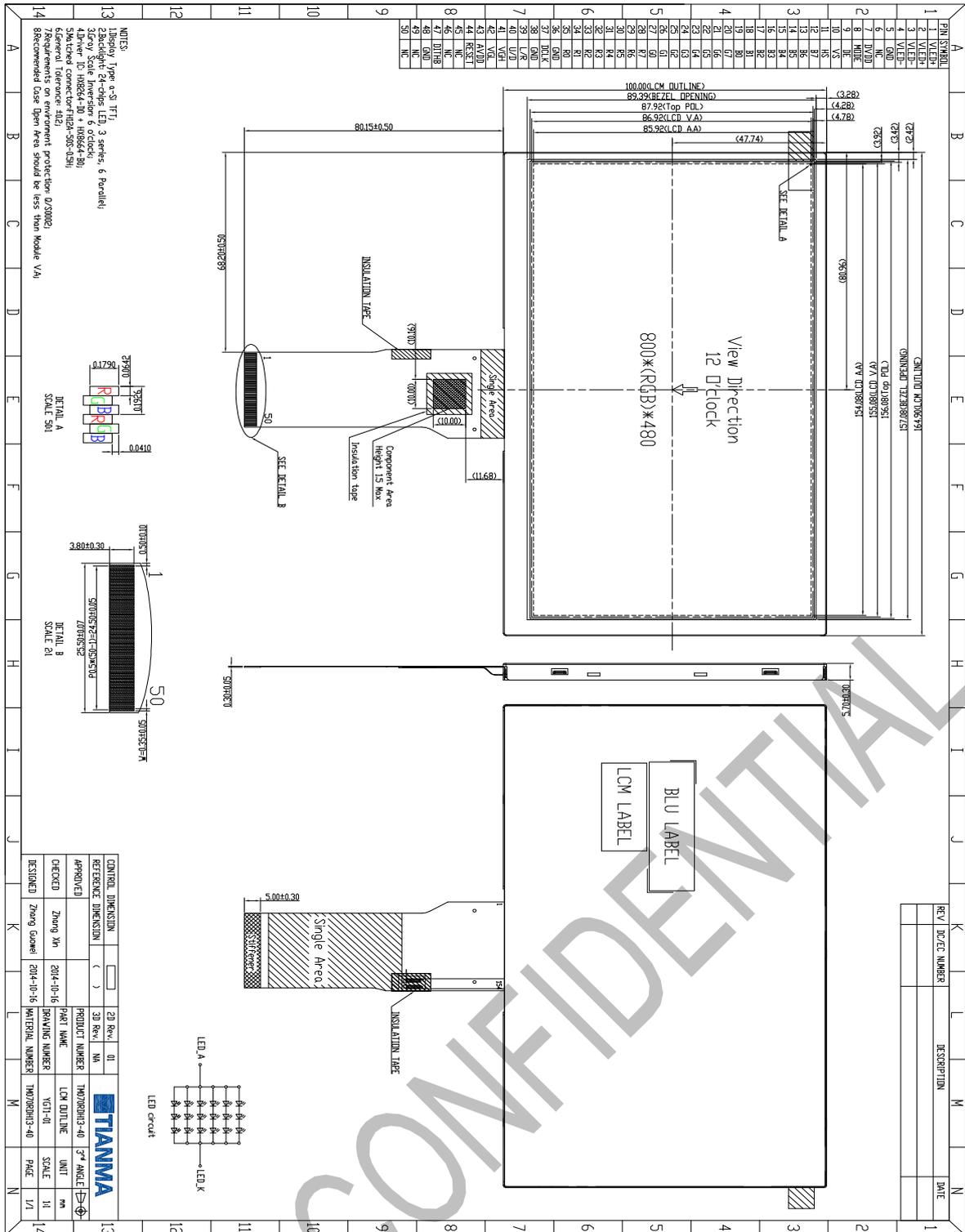
## 9 Packing Drawing

| NO | Item | Model (material) | Dimensions(mm) | Unit Weight(Kg) | Quantity | Remark |
|---|---|---|---|---|---|---|
| 1 | LCM Module | TM070RDH13 | 164.9×100.0×5.7 | 0.16 | 50 | |
| 2 | Partition_1 | Corrugated paper | 513×333×215 | 1.571 | 1 | |
| 3 | Anti-static Bag | PE | 180×160×0.05 | 0.001 | 50 | Anti-static |
| 4 | Dust-Proof Bag | PE | 700×530 | 0.06 | 1 | |
| 5 | Partition_2 | Corrugated Paper | 505×332×4.0 | 0.098 | 2 | |
| 6 | Corrugated Bar | Corrugated Paper | 513×146×19.5 | 0.057 | 4 | |
| 7 | Carton | Corrugated Paper | 530×350×250 | 1.12 | 1 | |
| 8 | Model Label | | 35×15 | 0.001 | 1 | |
| 9 | Total Weight | 11.226±5% | | | | |
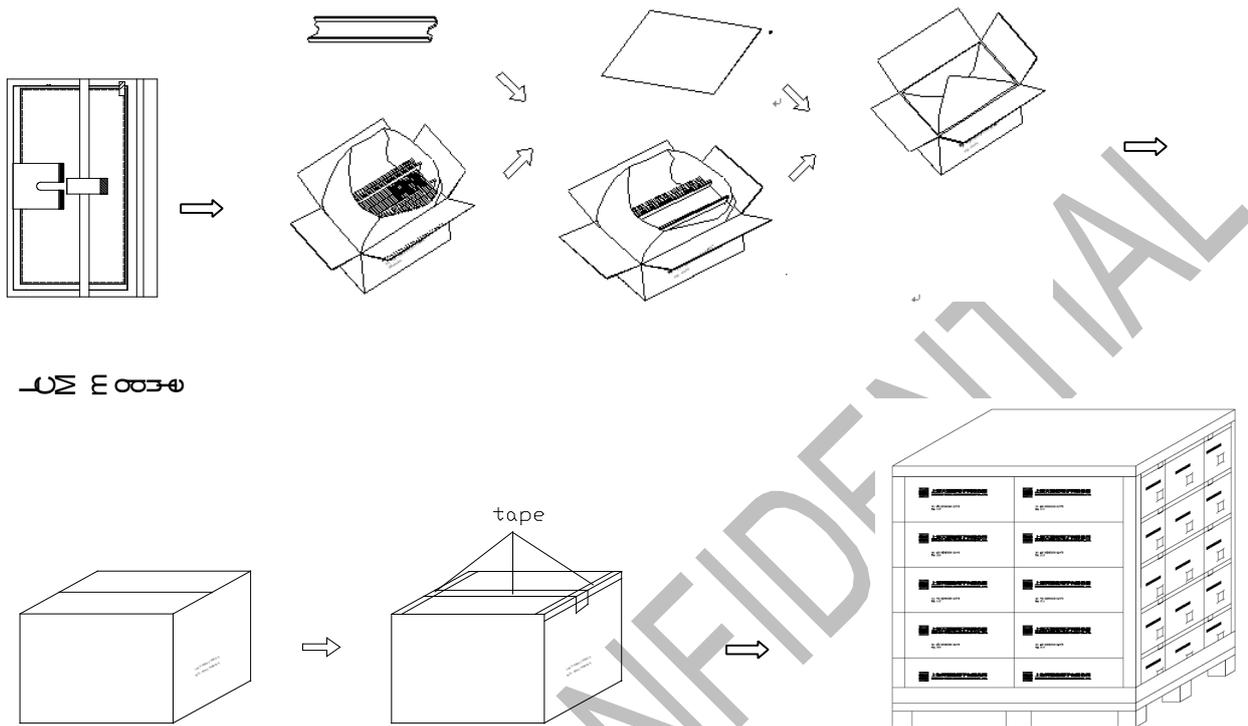
# 10 Precautions for Use of LCD Modules

a)          Handling Precautions

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

ii.          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.

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

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

v.          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

vi.          Do not attempt to disassemble the LCD Module.

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

viii.          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.

b)          Storage precautions

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

ii.          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%

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

c)          Transportation Precautions

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