深圳市拓普微科技开发有限公司
SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# LMT070DNCFWD-2

LCD Module User Manual

| Prepared by: | Checked by: | Approved by: |
|---|---|---|
| **Song Mao** | | |
| Date: 2021-09-01 | Date: | Date: |

| Rev. | Descriptions | Edit | Release Date |
|---|---|---|---|
| 0.1 | Preliminary release | Song Mao | 2021-01-25 |
| 0.2 | Add Backlight Operating Life Time | Song Mao | 2021-09-01 |
| | | | |
| | | | |

# Table of Content

# 1. Applications

This Module is designed for portable DVD, GPS car TV & PMP(portable multimedia player) application which require high quality flat panel displays. It is also a good substitute for many outmoded CSTN module in the industrial application.

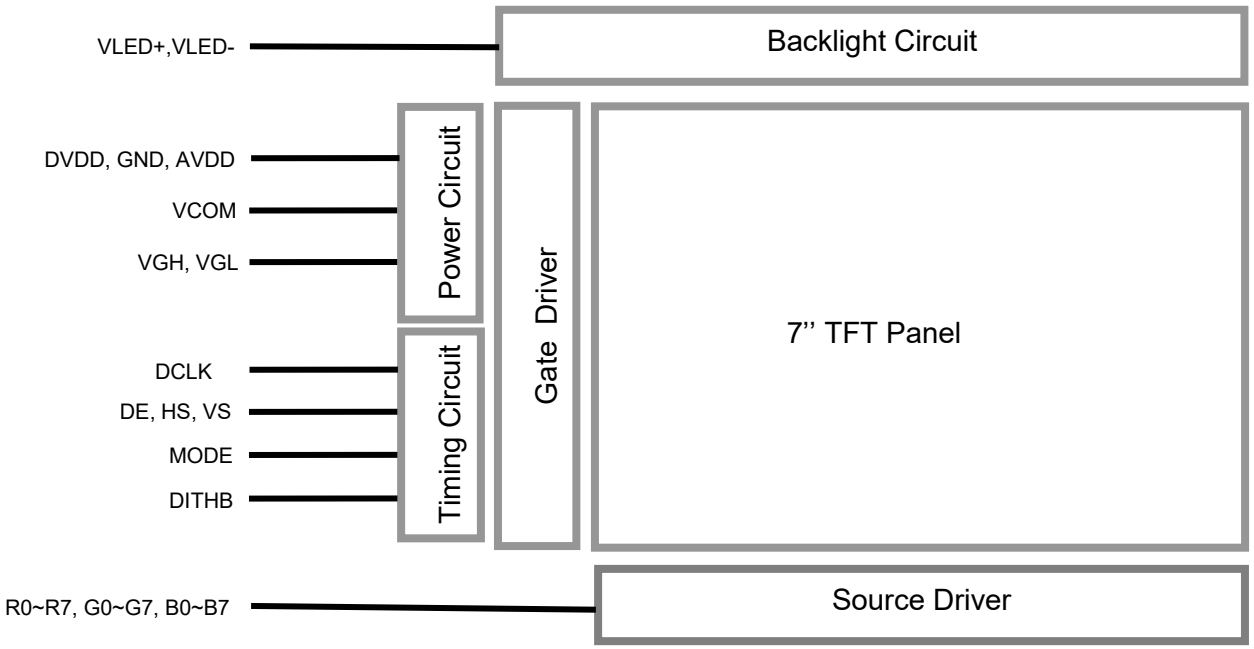
This product is composed of a TFT-LCD panel, driver ICs, FPC and LED backlight unit.

# 2. General Specification

| | |
|---|---|
| Screen Size(Diagonal) : | 7.0” |
| Active Area : | 154.08 x 85.92 (mm) |
| Number of dots : | 800 (RGB) x 480 |
| Pixel Pitch： | 0.1926x0.1790(mm) |
| Color Depth: | 16.7M colors |
| Display Technology : | a-Si TFT active matrix |
| Display Mode : | Normal White, Transmissive |
| Display Interface : | RGB |
| Viewing Direction : | 6 o’clock(Gray scale Inversion) (*1)<br>12 o’clock (*2) |
| Touch Panel : | - |
| Surface Treatment : | Anti-Glare |
| Operating Temperature : | -20 ~ +70°C |
| Storage Temperature : | -30 ~ +80°C |

Note:
*1. For saturated color display content (eg. pure-red, pure-green, pure-blue or pure-colors-combinations).
*2. For “color scales” display content.

# 3. Block Diagram



## 4. Terminal Function (Input Terminal)

| Pin No. | Pin Name | I/O | Descriptions |
|---|---|---|---|
| 1 | VLED+ | Power | Positive Backlight Power Supply |
| 2 | VLED+ | | |
| 3 | VLED- | Power | Negative Backlight Power Supply |
| 4 | VLED- | | |
| 5 | GND | Power | Power GND (0V) |
| 6 | VCOM | Input | Common voltage |
| 7 | DVDD | Power | Power for Digital Circuit |
| 8 | MODE | Input | DE/SYNC mode select (*1) |
| 9 | DE | Input | Data input enable |
| 10 | VS | Input | Vertical Sync Input |
| 11 | HS | Input | Horizontal Sync Input |
| 12 | B7 | Input | 8bit Data for Blue |
| : | : | | |
| 19 | B0 | | |
| 20 | G7 | Input | 8bit Data for Green |
| : | : | | |
| 27 | G0 | | |
| 28 | R7 | Input | 8bit Data for Red |
| : | : | | |
| 35 | R0 | | |
| 36 | GND | Power | Power GND (0V) |
| 37 | DCLK | Input | Sample clock(*2) |
| 38 | GND | Power | Power GND (0V) |
| 39 | L/R | Input | Left / right selection (*3) |
| 40 | U/D | Input | Up/down selection (*3) |
| 41 | VGH | Power | Gate ON Voltage |
| 42 | VGL | Power | Gate OFF Voltage |
| 43 | AVDD | Power | Power for Analog Circuit |
| 44 | RESET | Input | Global reset pin (*4) |
| 45 | NC | - | No connection |
| 46 | VCOM | Input | Common Voltage |
| 47 | DITHB | Input | Dithering function (*5) |
| 48 | GND | Power | Power GND (0V) |
| 49 | NC | - | No connection |
| 50 | NC | | |

Note:

* 1: DE/SYNC mode select. Normally pull high.
  When select DE mode, MODE="1", VS and HS must pull high.
  When select SYNC mode, MODE= "0", DE must be grounded.
* 2: Data shall be latched at the falling edge of DCLK.
* 3: Selection of scanning mode

| Setting of scan control input | | Scanning direction |
|---|---|---|
| U/D | L/R | |
| 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 |

*4: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.
*5: Dithering function enable control, normally pull high.
When DITHB=" 1",Disable internal dithering function,6bit resolution
When DITHB=" 0",Enable internal dithering function,8bit resolution

# 5. Absolute Maximum Ratings

| Items | Symbol | Min. | Max. | Unit | Condition |
|---|---|---|---|---|---|
| Power voltage | DVDD | -0.3 | 3.96 | V | |
| | AVDD | -0.3 | 14.5 | V | |
| | VGH | -0.3 | 42.0 | V | |
| | VGL | VGH-42 | 0.3 | V | |
| | VGH -VGL | - | 42.0 | V | |
| Operating Temperature | TOP | -20 | 70 | ℃ | No Condensation |
| Storage Temperature | TST | -30 | 80 | ℃ | No Condensation |
| Operating and Storage Humidity | HSTG | 10% | 90% | %(RH) | |

Note:
*1. This rating applies to all parts of the module. And should not be exceeded.
*2. The operating temperature only guarantees operation of the circuit. The contrast, response speed, and the other specification related to electro-optical display quality is determined at the room temperature, $T_{OP}$=25.
*3. Ambient temperature when the backlight is lit (reference value)
*4. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

# 6. Electrical Characteristics

## 6.1 DC Characteristics

| Items | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Power voltage | DVDD | 3.0 | 3.3 | 3.6 | V | *2 |
| | AVDD | 10.2 | 10.4 | 10.6 | V | |
| | VGH | 15 | 16 | 17 | V | |
| | VGL | -7.5 | -7.0 | -6.5 | V | |
| Input signal voltage | VCOM | 4.05 | 4.15 | 4.25 | V | |
| Input logic high voltage | VIH | 0.7VDD | - | DVDD | V | *3 |
| Input logic low voltage | VIL | 0 | - | 0.3DVDD | V | |

Note:
*1.Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.
*2: DVDD setting should match the signals output voltage (refer to Note 3) of customer's system board.
*3: DCLK,HS,VS,RESET,U/D, L/R,DE,R0~R7,G0~G7,B0~B7,MODE,DITHB.

## 6.2 Current Consumption

| Items | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Current for Driver | $I_{GH}$ | - | 0.3 | - | mA | VGH = 16.0V |
| | $I_{GL}$ | - | 0.3 | - | mA | VGL = -7.0V |
| | $I_{DVDD}$ | - | 4 | - | mA | DVDD=3.3V |
| | $I_{AVDD}$ | - | 30 | - | mA | AVDD=10.4V |

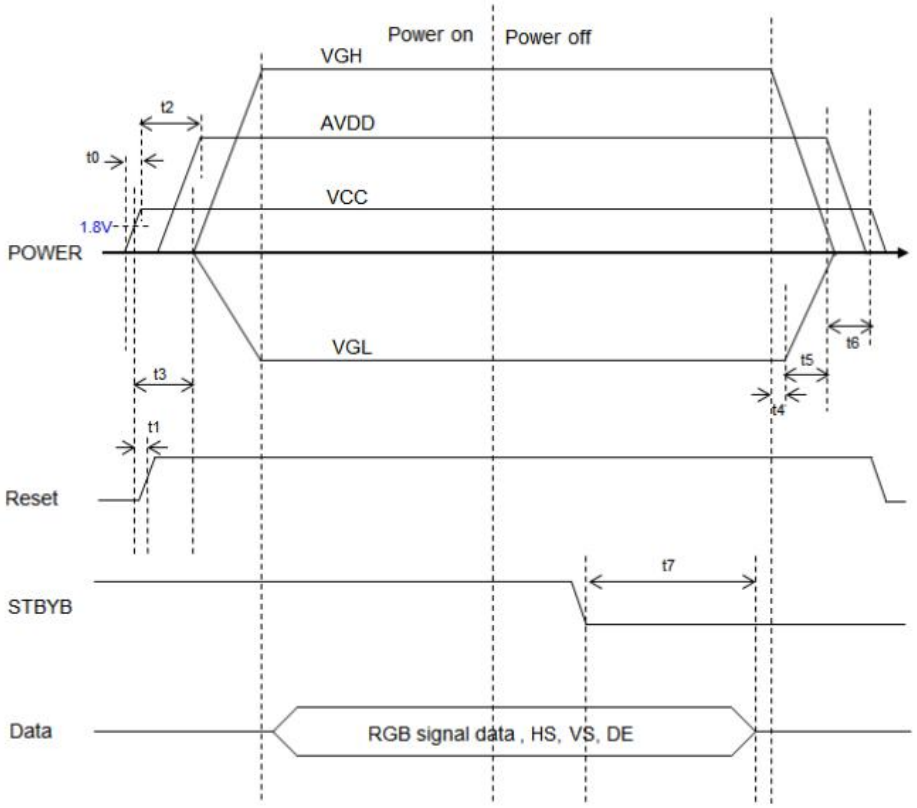
## 6.3 LED Backlight Circuit Characteristics

Top=25℃

| Items | Symbol | MIN. | TYP. | MAX. | Unit | Note |
|---|---|---|---|---|---|---|
| Forward Voltage | $Vf_{BLA}$ | 8.4 | 9.6 | 10.5 | V | If=180mA |
| Forward Current | $If_{BLA}$ | - | 180.0 | - | mA | |
| Backlight Operating Life Time | - | 50000 | - | - | Hrs | *1 |

Cautions:
*1. Optical performance should be evaluated at Ta=25℃. 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% of initial brightness. Typical operating life time is an estimated data.

### 6.4 Power Sequence




Note1: t0<20ms, t1>1ms, t2>16ms, t3≥0ms, t4≥0ms, t5≥0ms, t6≥0ms, t7≥8 frames(will be helpful to release the electric charge on panel)

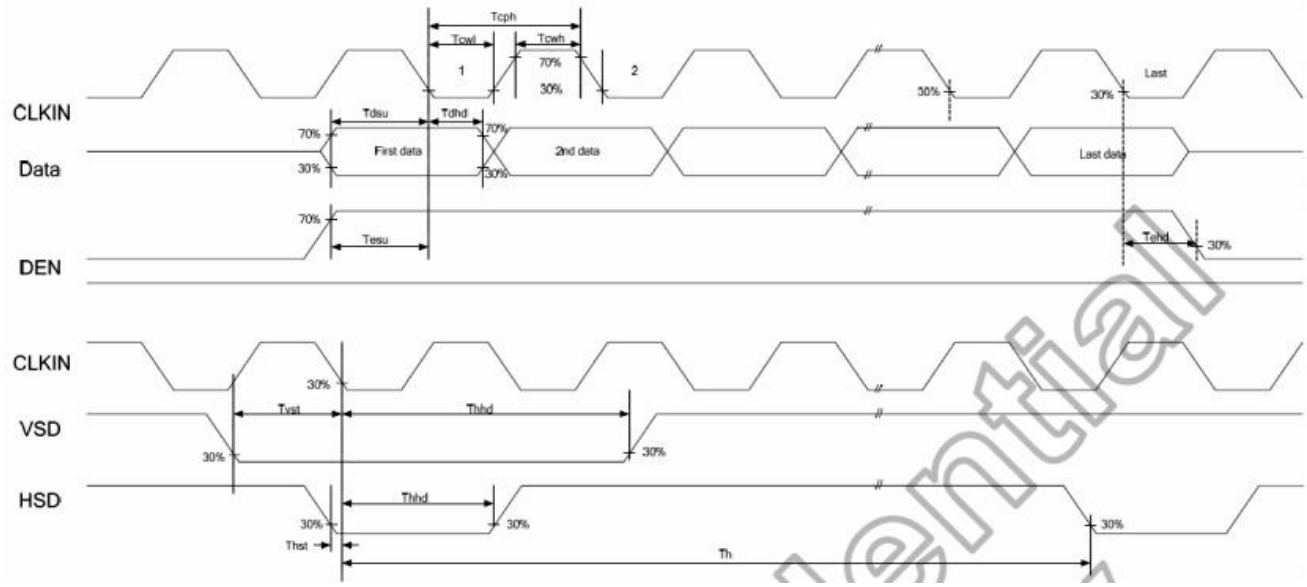
## 7. AC Characteristics

### 7.1 Timing Characteristics

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| HS setup time | Thst | 8 | - | - | ns | |
| HS hold time | Thhd | 8 | - | - | ns | |
| VS setup time | Tvst | 8 | - | - | ns | |
| VS hold time | Tvhd | 8 | - | - | ns | |
| Data setup time | Tdsu | 8 | - | - | ns | |
| Data hole time | Tdhd | 8 | - | - | ns | |
| DE setup time | Tesu | 8 | - | - | ns | |
| $DV_{DD}$ Power On Slew rate | TPOR | - | - | 20 | ms | From 0 to 90% $DV_{DD}$ |
| DCLK cycle time | Tcph | 20 | - | - | ns | |
| DCLK pulse duty | Tcwh | 40 | 50 | 60 | % | |

Note: For the details of the timing, please see the Driver IC data sheet.

## 7.2 Input Clock and Data Timing Diagram




## 7.3 Timing

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| Horizontal Display Area | thd | - | 800 | - | DCLK | |
| DCLK Frequency | fclk | 28 | 33.3 | 40 | MHz | |
| One Horizontal Line | th | 862 | 1056 | 1200 | DCLK | |
| HS pulse width | thpw | 1 | - | 40 | DCLK | |
| HS Blanking | thb | 46 | 46 | 46 | DCLK | |
| HS Front Porch | thfp | 16 | 210 | 354 | DCLK | |

| Item | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| Vertical Display Area | tvd | - | 480 | - | TH | |
| VS period time | tv | 513 | 525 | 650 | TH | |
| VS pulse width | tvpw | 3 | - | 20 | TH | |
| VS Blanking | tvb | 23 | 23 | 23 | TH | |
| VS Front Porch | tvfp | 7 | 22 | 147 | TH | |

## 7.4 Data Input Format

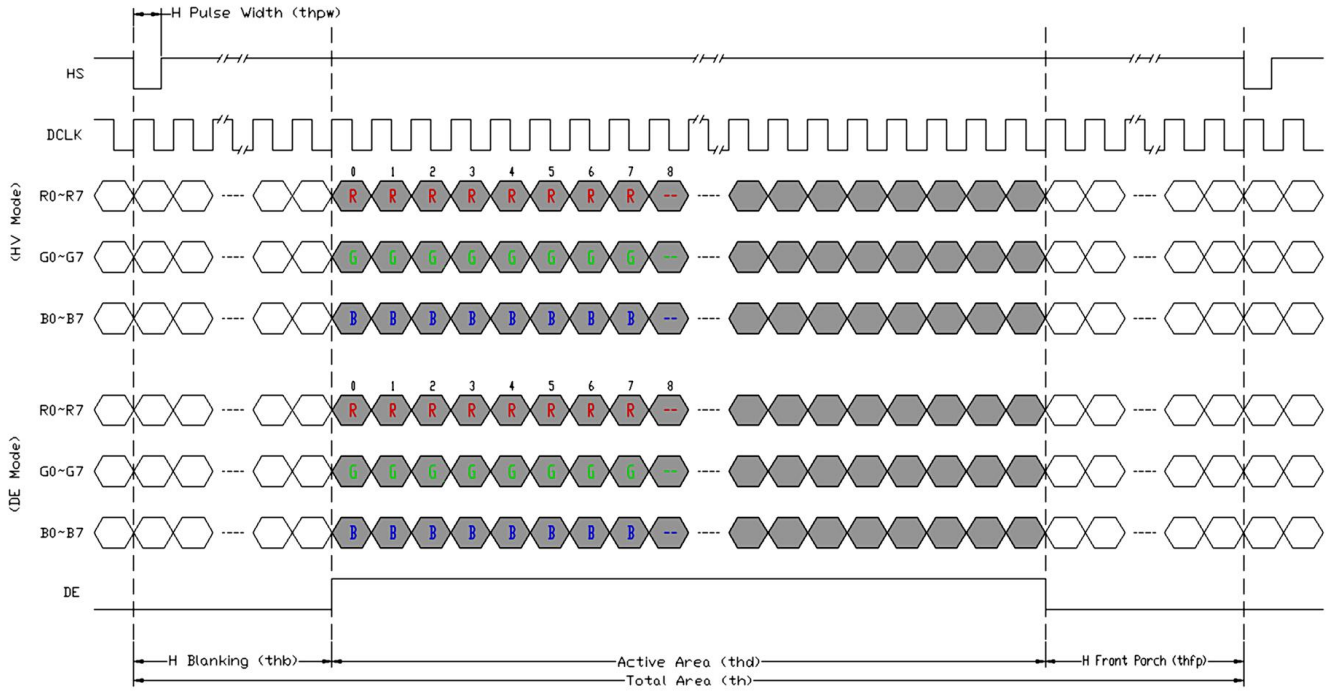



**Figure 6-2-1 Horizontal input timing diagram.**

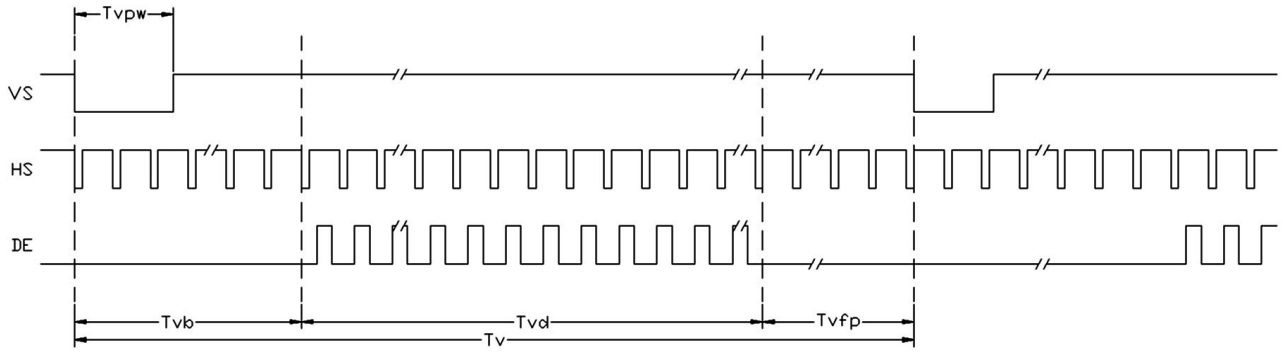


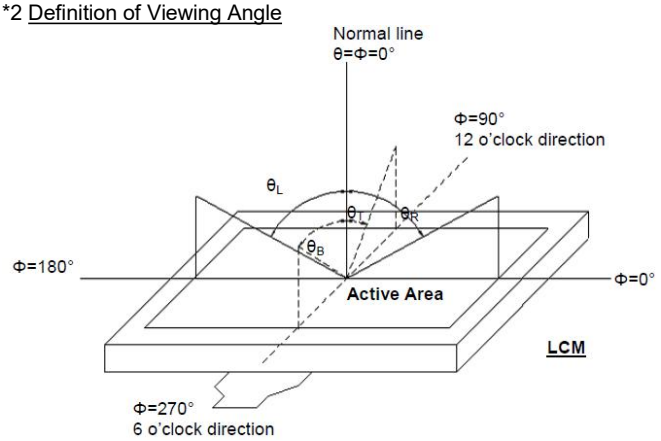

**Figure 6-2-2 Vertical input timing diagram.**

## 7.5 Optical Characteristics

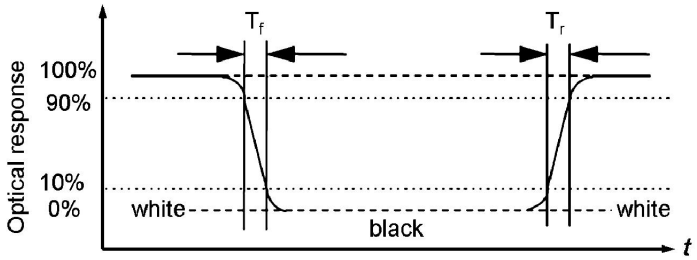
| Item | Symbol | Condition | MIN. | TYP. | MAX. | UNIT | Note. |
|---|---|---|---|---|---|---|---|
| Viewing angle (CR≥10) | $\theta_L$ | 9 o'clock | 60 | 80 | - | degree | *2 |
| | $\theta_R$ | 3 o'clock | 60 | 80 | - | | |
| | $\theta_T$ | 12 o'clock | 50 | 60 | - | | |
| | $\theta_B$ | 6 o'clock | 60 | 80 | - | | |
| Response Time | $T_f$ | Normal θ=0° | - | 25 | 35 | msec | *3 |
| | $T_r$ | | | | | msec | |
| Contrast ratio | CR | | 600 | 800 | - | - | *1 |
| Color chromaticlty | $W_X$ | | 0.27 | - | 0.33 | - | |
| | $W_Y$ | | 0.27 | - | 0.33 | - | |
| Luminance | L | | - | 500 | - | cd/m² | *4 |
| Luminance uniformity | $Y_U$ | | 70 | - | - | % | *4 |

Note:
*1. Definition of Contrast Ratio
The contrast ratio could be calculate by the following expression:
Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black

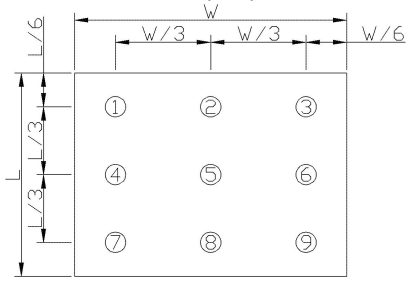
*2 Definition of Viewing Angle




*3 Definition of response time




*4 Definition of Luminance Uniformity
Luminance uniformity (Lu)=
Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



# 8. LCD Module Design and Handling Precautions

- Please ensure V0, VCOM is adjustable, to enable LCD module get the best contrast ratio under different temperatures, view angles and positions.

- Normally display quality should be judged under the best contrast ratio within viewable area. Unexpected display pattern may com out under abnormal contrast ratio.
- Never operate the LCD module exceed the absolute maximum ratings.
- Never apply signal to the LCD module without power supply.

- Keep signal line as short as possible to reduce external noise interference.
- IC chip (e.g. TAB or COG) is sensitive to light. Strong light might cause malfunction. Light sealing structure casing is recommended.

- Make sure there is enough space (with cushion) between case and LCD panel, to prevent external force passed on to the panel; otherwise that may cause damage to the LCD and degrade its display result.
- Avoid showing a display pattern on screen for a long time (continuous ON segment).

- LCD module reliability may be reduced by temperature shock.
- When storing and operating LCD module, avoids exposure to direct sunlight, high humidity, high or low temperature. They may damage or degrade the LCD module.
- Never leave LCD module in extreme condition (max./min storage/operate temperature) for more than 48hr.
- Recommend LCD module storage conditions is 0 C~40 C <80%RH.
- LCD module should be stored in the room without acid, alkali and harmful gas.
- Avoid dropping & violent shocking during transportation, and no excessive pressure press, moisture and sunlight.
- LCD module can be easily damaged by static electricity. Please maintain an optimum anti-static working environment to protect the LCD module. (eg. ground the soldering irons properly)
- Be sure to ground the body when handling LCD module.
- Only hold LCD module by its sides. Never hold LCD module by applying force on the heat seal or TAB.
- When soldering, control the temperature and duration avoid damaging the backlight guide or diffuser which might degrade the display result such as uneven display.
- Never let LCD module contact with corrosive liquids, which might cause damage to the backlight guide or

## 8. 液晶显示模块设计和使用须知

- 请注意 VO, VCOM 的设定，以确保液晶显示模块在不同的使用温度下以及在不同的视角和位置观察模块显示，均能达到最佳对比度，请务必将应用电路上设置为对比度可调。
- 请注意液晶显示模块的显示品质判定是指在正常对比度下以及视窗(V.A)范围内进行的，非正常对比度下液晶可能会出现非预期的显示不良，应注意区分。
- 请勿在最大额定值以外使用液晶显示模块。

- 请勿在没有接通电源的条件下，给液晶显示模块输送信号。
- 请尽可能缩短信号线的连接，以避免对液晶显示模块的信号干扰。
- 集成电路因 IC 芯片(如 TAB 或 COG)对紫外线极为敏感，强光环境下可能会引起液晶显示模块功能失效，故应采用不透光的外壳。
- 请在液晶显示模块与外壳之间保留足够的空间(可使用衬垫)，以缓冲外力对液晶显示模块的损坏或因受力不均而产生的显示不匀等异常现象。

- 避免液晶显示屏在某一画面下长时间点亮，否则有出现残影的风险；请通过软件每隔一段时间改变一次画面。
- 液晶显示模块的可靠性可能因温度冲击而降低。
- 请勿在阳光直射、高湿、高温或低温下储存和使用液晶显示模块，这将造成液晶显示模块的损坏或失效。

- 请勿在极限环境(最大/最小存储/工作温度)下使用或放置液晶显示模块超过 48 小时以上。
- 液晶显示模块建议存储条件为：0 C~40 C <80%RH。
- 请勿让液晶显示模块存储于带有 酸性，碱性，有害气体环境之中。
- 在运输过程中，请勿让液晶显示模块跌落与猛烈震动，同时避免 异常挤压，高湿度，与阳光照射.
- 液晶显示模块极易受静电损坏，请务必保证液晶显示模块在防静电的工作环境中使用或保存。(如：烙铁正确接地,等)
- 拿取液晶显示模块时需注意操作人员的接地情况。
- 请手持液晶显示模块的边沿取放模块，防止热压纸或 TAB 部位受力。
- 焊接液晶模块时，请注意控制烙铁的温度、焊接时间，以免烫坏导光板或偏光片，导致显示不匀等不良现象发生。
- 请勿使用洗板水等腐蚀性液体接触液晶模块，以免腐蚀导光板或模块电路。

- 仅可使用柔软的干布，异丙醇或乙醇清洁液晶屏表面，其他任何溶剂(如:水)都有可能损坏液晶模块。

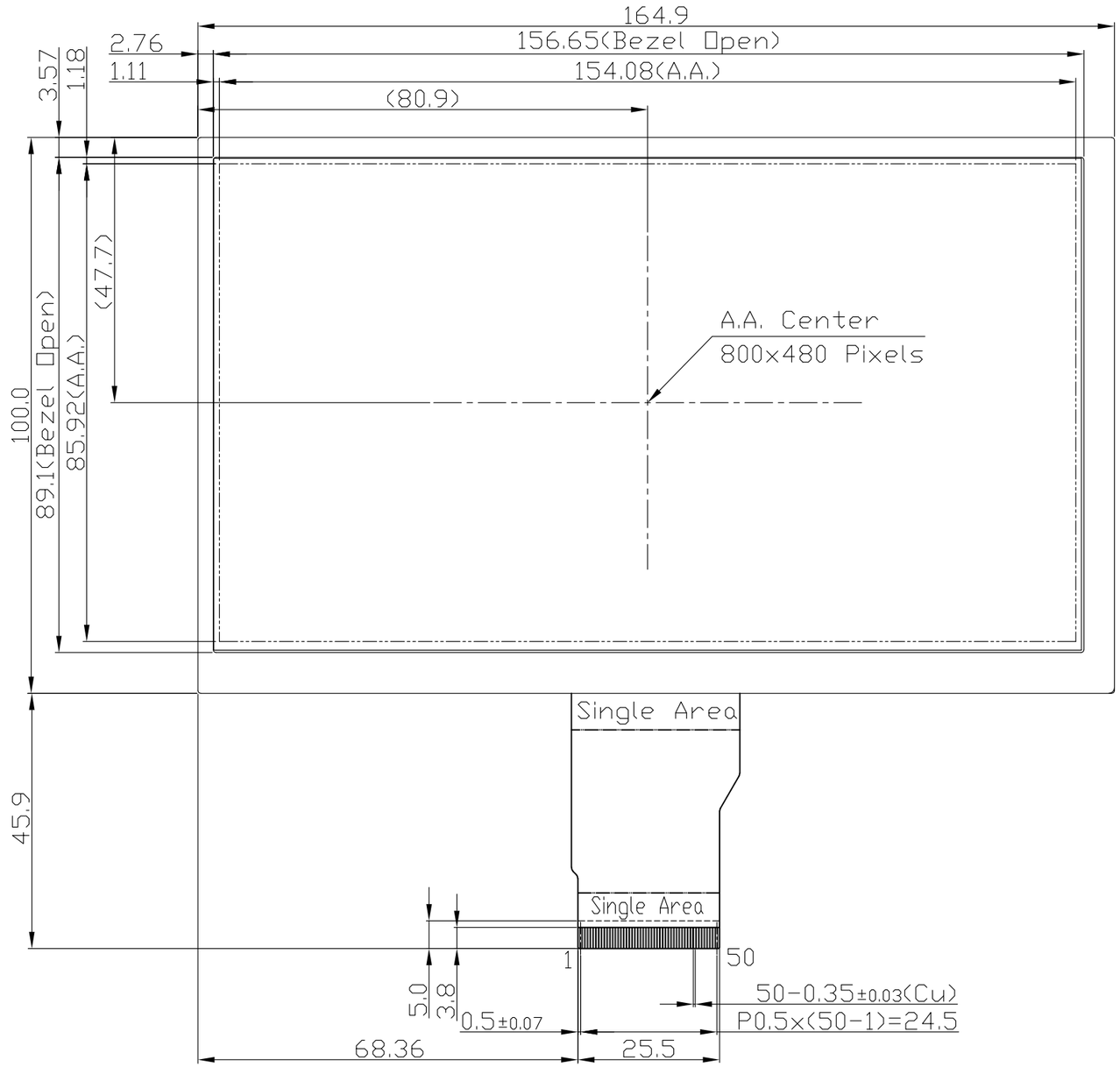
the electric circuit of LCD module.
- Only clean LCD with a soft dry cloth, Isopropyl Alcohol or Ethyl Alcohol. Other solvents (e.g. water) may damage the LCD.
- Never add force to components of LCD module. It may cause invisible damage or degrade the module's reliability.
- When mounting LCD module, please make sure it is free from twisting, warping and bending.
- Do not add excessive force on surface of LCD, which may cause the display color change abnormally.
- LCD panel is made with glass. Any mechanical shock (e.g. dropping from high place) will damage the LCD module.

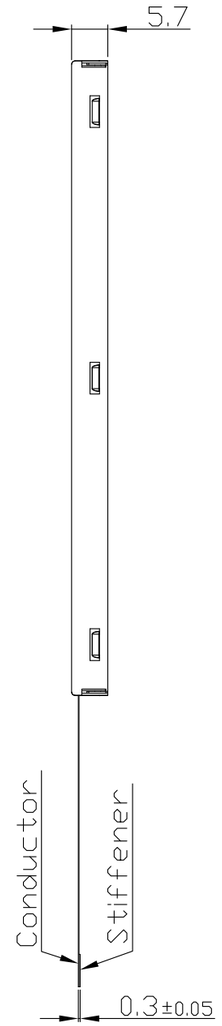
- 请勿挤压液晶显示模块上的元器件，以避免产生潜在的损坏或失效而影响产品可靠性。
- 装配液晶显示模块时，请务必注意避免液晶显示模块的扭曲或变形。
- 请勿挤压液晶显示屏表面，这将导致显示颜色的异常。
- 液晶屏由玻璃制作而成，任何机械碰撞(如从高处跌落)均有可能损坏液晶显示模块。

## Warranty

This product has been manufactured to our company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- We cannot accept responsibility for any defect, which may arise form additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed our company's acceptance inspection procedures.
- When the product is in CCFL models, CCFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.
- We cannot accept responsibility for intellectual property of a third part, which may arise through the application of our product to our assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.




| Terminal | |
|---|---|
| No | Pin Name |
| 1 | VLED+ |
| 2 | VLED+ |
| 3 | VLED- |
| 4 | VLED- |
| 5 | GND |
| 6 | VCOM |
| 7 | DVDD |
| 8 | MODE |
| 9 | DE |
| 10 | VS |
| 11 | HS |
| 12 | B7 |
| : | : |
| 19 | B0 |
| 20 | G7 |
| : | : |
| 27 | G0 |
| 28 | R7 |
| : | : |
| 35 | R0 |
| 36 | GND |
| 37 | DCLK |
| 38 | GND |
| 39 | L/R |
| 40 | U/D |
| 41 | VGH |
| 42 | VGL |
| 43 | AVDD |
| 44 | RESET |
| 45 | NC |
| 46 | VCOM |
| 47 | DITHB |
| 48 | GND |
| 49 | NC |
| 50 | NC |

Note:
*1. LCD Display Type : TFT,Transmissive
*2. Pixel Arrangment : RGB-STRIPE
*3. Operating Voltage : 3.3V
*4. Logic Voltage : 3.3V
*5. Backlight Color : White LED
*6. Backlight Supply : 180mA (Constant Current VF=9.6V typ.)
*7. Color Depth : 16.7M Colors
*8. Interface : RGB_24bit
*9. Operating Temperature : -20°C~70°C
*10. Storage Temperature : -30°C~80°C

| Rev | Note | Date |
|---|---|---|
| C | | |
| B | | |
| A | | |

Dwg Title: LMT070DNCFWD-2 Outline Dwg

Dwg No.: MK-007192-1-1

Date: 2021-01-22

| Scale | Tol. | Unit | Paper Size |
|---|---|---|---|
| 1/1 | ±0.3 | mm | A3 |

| Approved | Checked | Drawn |
|---|---|---|
| | | yangwukun |

TOPWAY