

# 深圳市金逸晨电子有限公司

ShenZhen GoldenMorning Electronic Co.,Ltd

|                             |                    |
|-----------------------------|--------------------|
| <b>Model NO</b><br>型号       | GMT024-06          |
| <b>Product Name</b><br>产品名称 | 2.4 TFT LCD Module |
| <b>Version</b><br>版本号       | V1                 |
| <b>Date</b><br>日期           | 2024-02-19         |

☐ Preliminary Specification（规范草案）

☒ Final Specification（最终规格）

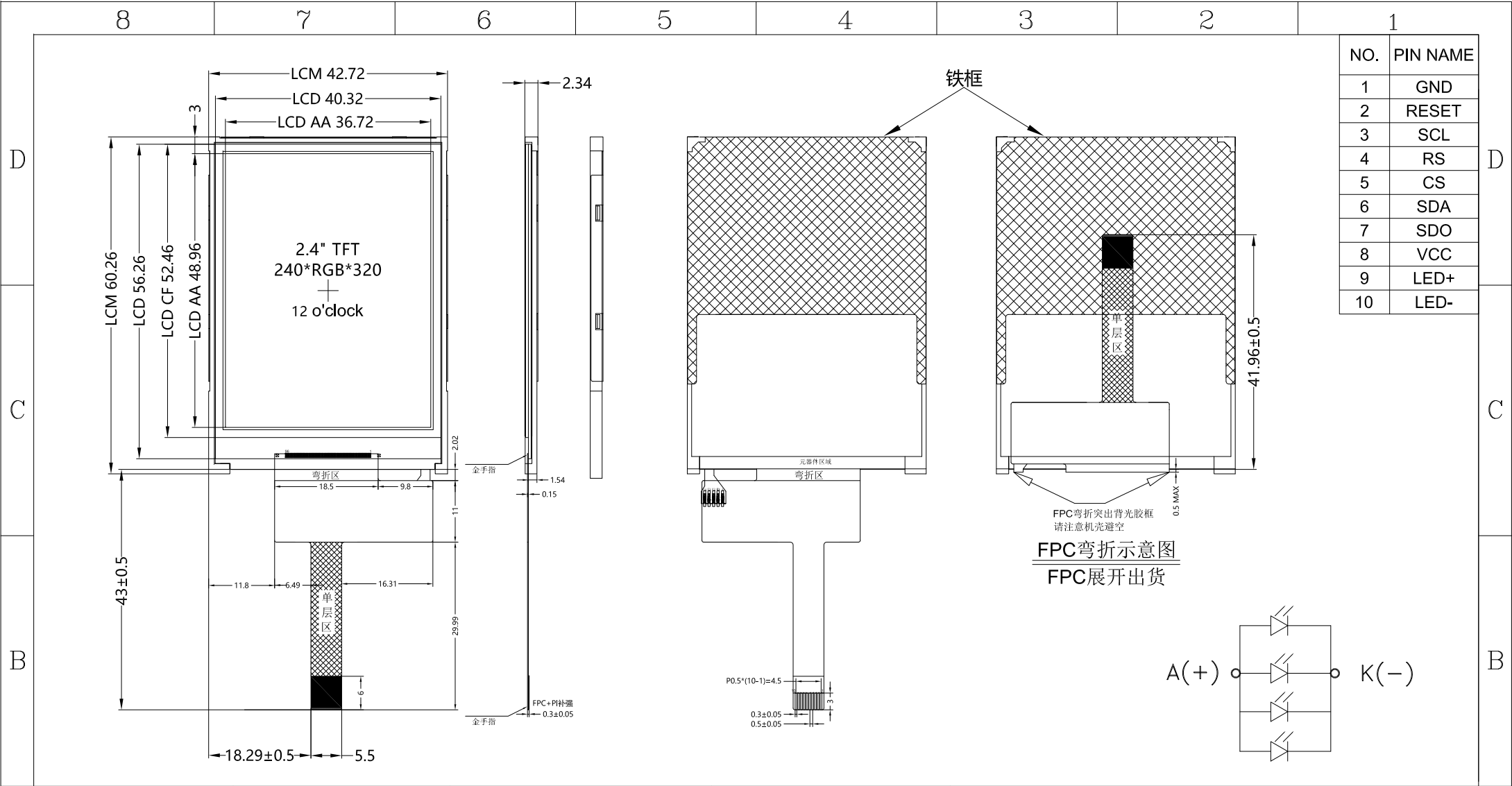
|                       |                        |                        |
|-----------------------|------------------------|------------------------|
| <b>PREPARED</b><br>编辑 | <b>CHECKED</b><br>检查核对 | <b>APPROVED</b><br>审批人 |
|                       |                        |                        |

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## 1. General Specifications (概况)

| Item<br>项目                  | Specification<br>规格           | Unit<br>单位 |
|-----------------------------|-------------------------------|------------|
| Display Mode<br>显示模式        | Normally Black, Transmissive  | /          |
| Viewing Direction<br>视角方向   | 12 o'clock                    | /          |
| Colors<br>颜色                | 262K                          | /          |
| Drive IC<br>驱动IC            | ST7789                        | /          |
| Interface Type<br>接口类型      | 4 Line SPI                    | /          |
| Dimensional Outline<br>模组尺寸 | 42.72(W) x 60.26(H) x 2.34(T) | mm         |
| LCD Active Area<br>LCD有效区域  | 36.72(W) x 48.96(H)           | mm         |
| Resolution<br>分辨率           | 240 RGB(H) x 320(V)           | pixels     |
| Pixel Pitch<br>像素间距         | 0.153(W) x 0.153(H)           | mm         |



|   |                   |                |                       |                          |                                                                                                                                      |   |   |   |   |
|---|-------------------|----------------|-----------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|
| A | Display Type      | TFT            | LCM Luminance         | 400cd/m <sup>2</sup> TYP | 深圳市金逸晨电子有限公司<br>ShenZhen GoldenMorning Electronic Co.,Ltd                                                                            |   |   |   |   |
|   |                   | Normally Black | Backlight             | White Color              |                                                                                                                                      |   |   |   |   |
|   | Number of pixels  | 240RGB*320     |                       | IF=80mA,VF=3.2V          | LCM NO: GMT024-06<br>v1                                                                                                              |   |   |   |   |
|   | Viewing Direction | 12 o'clock     | Operating temperature | -20°C+70°C               |                                                                                                                                      |   |   |   |   |
|   | Color             | 262K           | Storage temperature   | -30°C+80°C               | UNITS:MM<br>SCALE: FIT<br>DESIGNED BY: 岳亚卿<br>CHECKED BY: 张勇<br>APPROVED BY:<br>SHEET: 1 OF 1<br>UNIT: MM DATE 2024-02-19 2024-02-19 |   |   |   |   |
|   | Drive IC          | ST7789         | RoHS                  | YES                      |                                                                                                                                      |   |   |   |   |
|   | Interface         | 4 Line SPI     | Unspecified Tolerance | ±0.1                     |                                                                                                                                      |   |   |   |   |
|   |                   | 8              | 7                     | 6                        | 5                                                                                                                                    | 4 | 3 | 2 | 1 |

### 3. Maximum Ratings (极限参数)

| Parameter<br>参数                 | Symbol<br>符号 | Min<br>最小 | Max<br>最大   | Unit<br>单位 |
|---------------------------------|--------------|-----------|-------------|------------|
| Logic Supply Voltage<br>逻辑电源电压  | IOVCC        | -0.3      | 4.6         | V          |
| Analog Supply Voltage<br>模拟电源电压 | VCC          | -0.3      | 4.6         | V          |
| Operating temperature<br>工作温度   | Top          | -20       | 70          | °C         |
| Storage temperature<br>储存温度     | Tst          | -30       | 80          | °C         |
| Humidity<br>湿度                  | RH           | --        | 90%(Max60C) | RH         |

### 4. ELECTRICAL CHARACTERISTICS (电气特性)

| Parameter<br>参数                 | Symbol<br>符号 | Min<br>最小 | Typ<br>典型 | Max<br>最大 | Unit<br>单位 |
|---------------------------------|--------------|-----------|-----------|-----------|------------|
| Logic Supply Voltage<br>逻辑电源电压  | IOVCC        | 1.65      | 1.8/2.8   | 3.3       | V          |
| Analog Supply Voltage<br>模拟电源电压 | VCC          | 2.6       | 2.8       | 3.3       | --         |
| Input Current<br>输入电流           | Idd          | --        | 20        | --        | mA         |

### 5. BACKLIGHT CHARACTERISTICS (背光特性)

| Item<br>项目                  | Symbol<br>符号 | Min<br>最小 | Typ<br>典型 | Max<br>最大 | Unit<br>单位 | Condition<br>条件 |
|-----------------------------|--------------|-----------|-----------|-----------|------------|-----------------|
| Forward Voltage<br>正向电压     | Vf           | 3.0       | 3.2       | 3.4       | V          | --              |
| Forward Current<br>正向电流     | If           | --        | 80        | --        | mA         | --              |
| Operating Life Time<br>使用寿命 | --           | --        | 10000     | --        | Hrs        |                 |

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25°C  
(LED 电源电压由 Ta=25°C时的 LED 数量定义)

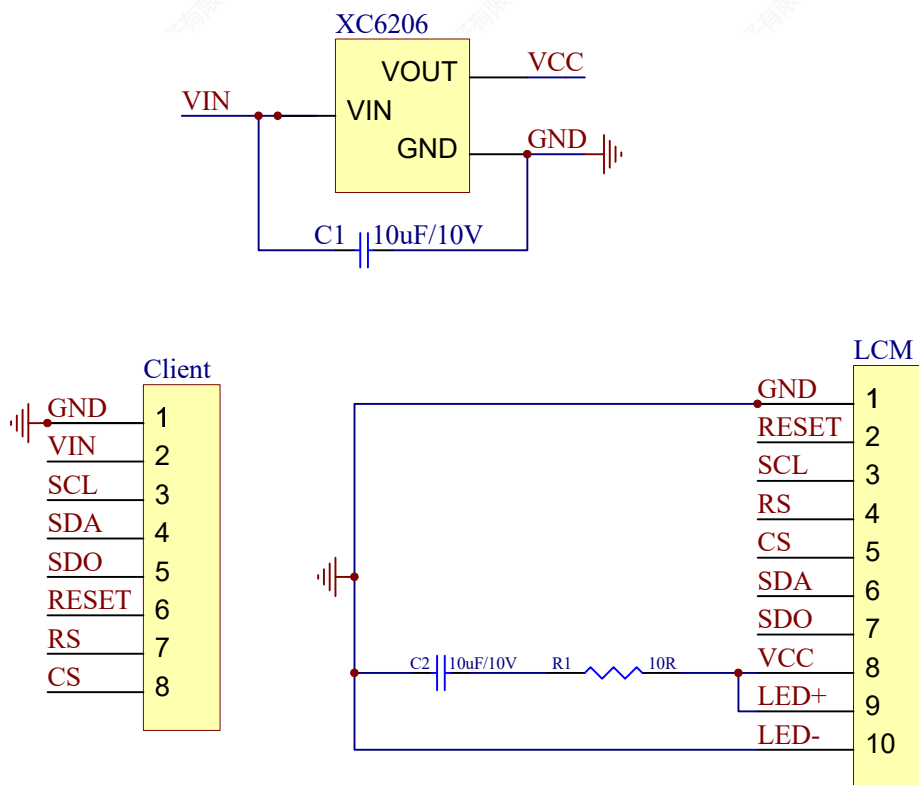
Note 2: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.  
(使用寿命意味着亮度降低到初始亮度的 50%。典型的使用寿命是估算数据。)

## 6. PIN DESCRIPTIONS (PIN 定义)

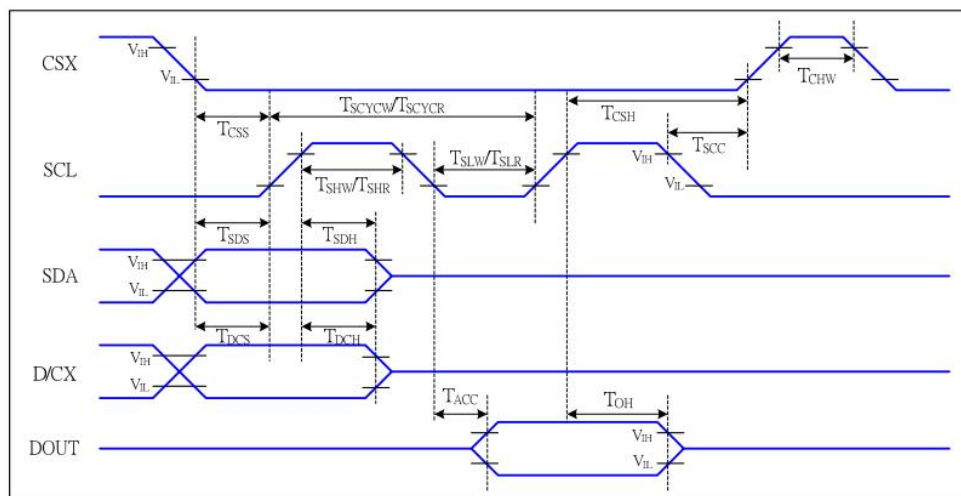
| Pin.No<br>编号 | Symbol<br>符号 | Description<br>说明                                                                                                     |
|--------------|--------------|-----------------------------------------------------------------------------------------------------------------------|
| 1            | GND          | Ground<br>(接地脚)                                                                                                       |
| 2            | RESET        | LCM Reset pin<br>(屏复位脚)                                                                                               |
| 3            | SCL          | Serial clock pin.<br>(串口时钟线)                                                                                          |
| 4            | RS           | Register select pin (指令/数据寄存器选择脚)<br>RS='1': Display data. (RS='1':选择数据寄存器)<br>RS='0': Command data. (RS='0':选择指令寄存器) |
| 5            | CS           | Chip select pin("Low" enable)<br>(屏驱动芯片片选脚, 低电平有效)                                                                    |
| 6            | SDA          | Serial data input<br>(串口数据输入脚)                                                                                        |
| 7            | SDO          | Serial data output.<br>(串口数据输出脚)                                                                                      |
| 8            | VCC          | Power supply for Analog (2.8V-3.3V)<br>(系统电压)                                                                         |
| 9            | LED+         | Anode of Backlight<br>(背光正极供电脚)                                                                                       |
| 10           | LED-         | Cathode of Backlight<br>(背光负极供电脚)                                                                                     |

**NOTE:** The backlight LED can be powered separately or share a set of voltage supply with the VCC.  
背光 LED 可以单独供电, 也可以和 VCC 共用一组电压供电)

## 7. Schematic Diagram (原理图)



## 8. Timing Characteristics（时序特性）



4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

| Signal<br>信号 | Symbol<br>符号 | Parameter<br>参数                | MIN<br>最小 | MAX<br>最大 | Unit<br>单位 | Description<br>描述                         |
|--------------|--------------|--------------------------------|-----------|-----------|------------|-------------------------------------------|
| CSX          | $T_{CSS}$    | Chip select setup time (write) | 15        |           | ns         |                                           |
|              | $T_{CSH}$    | Chip select hold time (write)  | 15        |           | ns         |                                           |
|              | $T_{CSS}$    | Chip select setup time (read)  | 60        |           | ns         |                                           |
|              | $T_{SCC}$    | Chip select hold time (read)   | 65        |           | ns         |                                           |
|              | $T_{CHW}$    | Chip select "H" pulse width    | 40        |           | ns         |                                           |
| SCL          | $T_{SCYCW}$  | Serial clock cycle (Write)     | 16        |           | ns         | -write command & data<br>ram              |
|              | $T_{SHW}$    | SCL "H" pulse width (Write)    | 7         |           | ns         |                                           |
|              | $T_{SLW}$    | SCL "L" pulse width (Write)    | 7         |           | ns         |                                           |
|              | $T_{SCYCR}$  | Serial clock cycle (Read)      | 150       |           | ns         | -read command & data<br>ram               |
|              | $T_{SHR}$    | SCL "H" pulse width (Read)     | 60        |           | ns         |                                           |
|              | $T_{SLR}$    | SCL "L" pulse width (Read)     | 60        |           | ns         |                                           |
| D/CX         | $T_{DCS}$    | D/CX setup time                | 10        |           | ns         |                                           |
|              | $T_{DCH}$    | D/CX hold time                 | 10        |           | ns         |                                           |
| SDA<br>(DIN) | $T_{SDS}$    | Data setup time                | 7         |           | ns         |                                           |
|              | $T_{SDH}$    | Data hold time                 | 7         |           | ns         |                                           |
| DOUT         | $T_{ACC}$    | Access time                    | 10        | 50        | ns         | For maximum CL=30pF<br>For minimum CL=8pF |
|              | $T_{OH}$     | Output disable time            | 15        | 50        | ns         |                                           |

4-line serial Interface Characteristics

Note : The rising time and falling time ( $T_r$ ,  $T_f$ ) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

## 9. OPTICAL CHARACTERISTICS (光学特性)

| Item<br>项目                                                                              | Symbol<br>符号 | Condition<br>条件    | Min.<br>最小 | Typ.<br>典型 | Max.<br>最大 | Unit<br>单位 | Note<br>备注 |
|-----------------------------------------------------------------------------------------|--------------|--------------------|------------|------------|------------|------------|------------|
| Response time (By Quick)<br>响应时间 (按快速)                                                  | Tr+Tf        | $\theta = 0^\circ$ | -          | 30         |            | ms         | Note 5     |
| Contrast ratio<br>对比度                                                                   | CR           | $\theta = 0^\circ$ | -          | 250        | -          |            | Note 2,6   |
| Viewing angle<br>视角                                                                     | Top          | $CR \geq 10$       | -          | 45         | -          | deg.       | Note 2,6,7 |
|                                                                                         | Bottom       | $CR \geq 10$       | -          | 20         | -          |            |            |
|                                                                                         | Left         | $CR \geq 10$       | -          | 45         | -          |            |            |
|                                                                                         | Right        | $CR \geq 10$       | -          | 45         | -          |            |            |
| Color chromaticity<br>(CF only with ITO,<br>light source is C<br>light, CIE 1931)<br>色度 | Wx           | $\theta = 0^\circ$ | -0.02      | 0.308      | +0.02      |            | Note 3     |
|                                                                                         | Wy           |                    |            | 0.325      |            |            |            |
|                                                                                         | Rx           |                    |            | 0.612      |            |            |            |
|                                                                                         | Ry           |                    |            | 0.329      |            |            |            |
|                                                                                         | Gx           |                    |            | 0.299      |            |            |            |
|                                                                                         | Gy           |                    |            | 0.567      |            |            |            |
|                                                                                         | Bx           |                    |            | 0.144      |            |            |            |
|                                                                                         | By           |                    |            | 0.110      |            |            |            |
| NTSC                                                                                    |              |                    | -          | 55         | -          | %          | Note 3     |
| Cross talk                                                                              | Ct           |                    | -          | 2          | -          | %          | Note 9     |
| Transmittance<br>透射率                                                                    | Trans        |                    | -          | 5          | -          | %          | Note 4     |

Note 1: Ambient temperature = 25°C.(环境温度=25° C。)

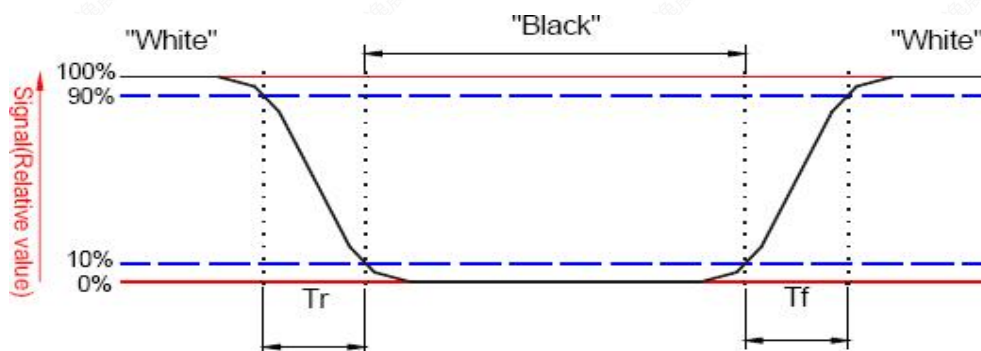
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.(用 Topcon 亮度计 BM-5A 在 2° 视锥下测量。)

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.(使用 Otsuta 色度计 LCF-2100M 测量, CF 仅在 C 光下测量模拟)

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is  $\pm 10\%$ .(CTC 运输状态为不带偏振光片, 规范的透射率是带有偏振光片的单元, 透光率公差为  $\pm 10\%$ 。)

Note 5: Definition of response time: The output signals of TRD-100 are measured when the input signals are changed to "White" (falling time) and from "White" to "Black" (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

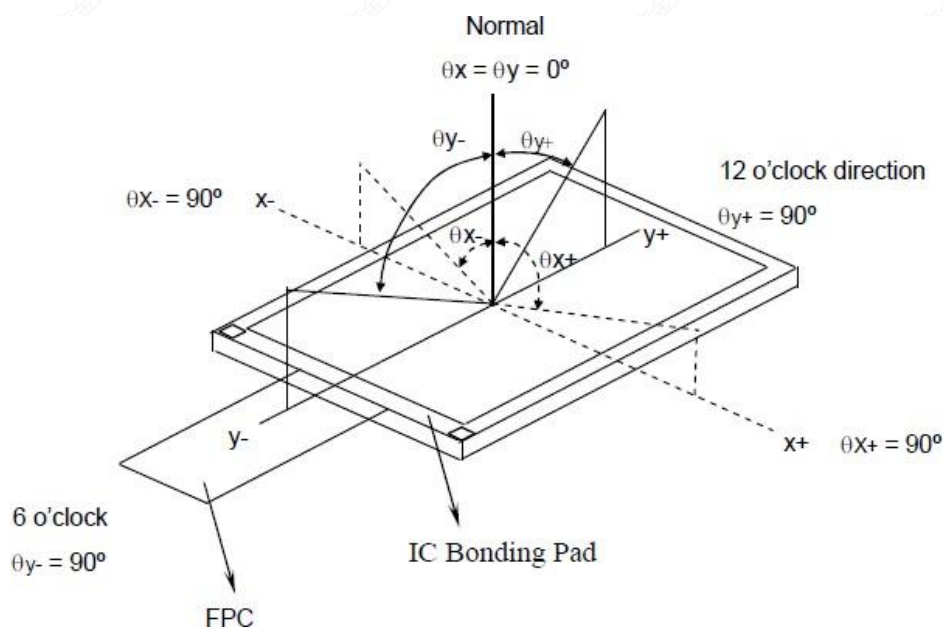
响应时间的定义：当输入信号分别变为“白色”（下降时间）和从“白色”变为“黑色”（上升时间）时，测量 TRD-100 的输出信号。该间隔在振幅的 10% 和 90% 之间。请参阅下图。



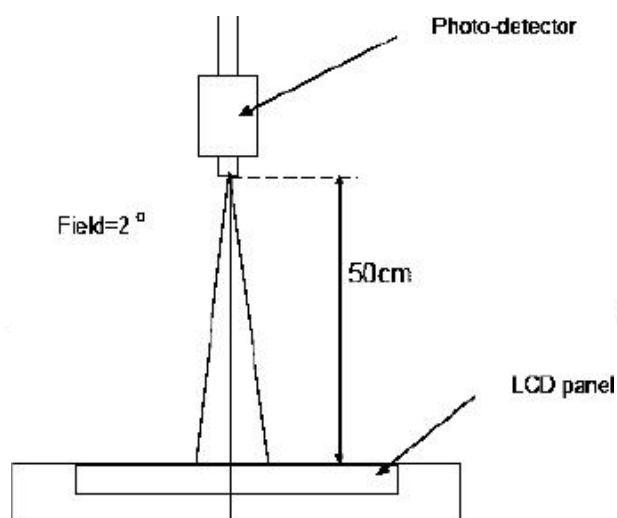
Note 6: Contrast ratio is calculated by the following formula（对比度由以下公式计算）：

$$\text{对比度 Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state} \quad \text{“白色”状态下的亮度}}{\text{Brightness on the "black" state} \quad \text{“黑色”状态下的亮度}}$$

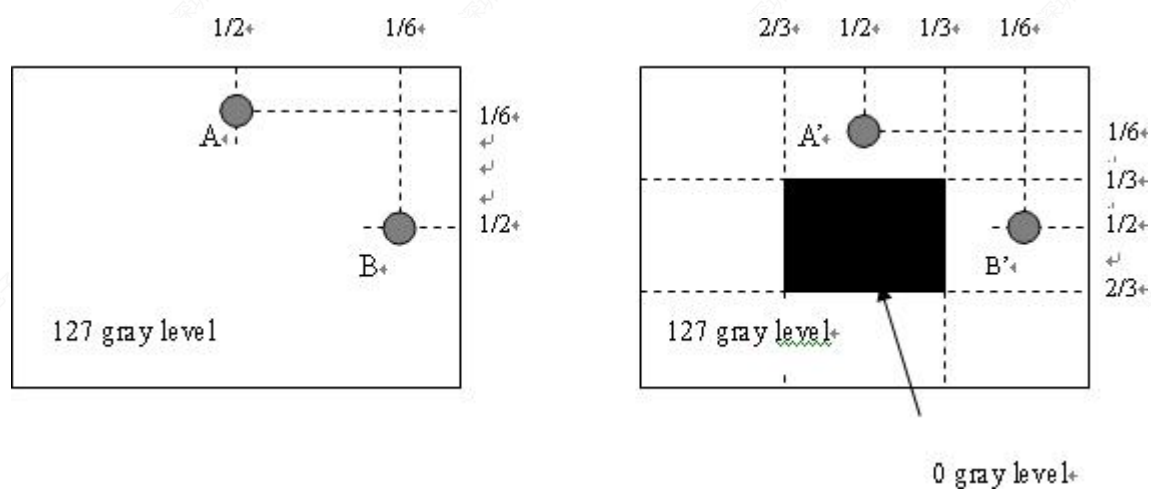
Note 7: Definition of viewing angle（视角的定义）



Note 8: Optical characteristic measurement setup. (光学特性测量设置)



Note 9:



$|LA - LA'| / LA \times 100\% = 2\% \text{ max.}$ , LA and LA' are brightness at location A and A'

$|LB - LB'| / LB \times 100\% = 2\% \text{ max.}$ , LB and LB' are brightness at location B and B'

## 10 Reliability (可靠性)

### 10.1 MTBF(平均故障间隔时间)

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal.  
LCD 模块的设计应满足正常情况下 50000 小时的最小 MTBF 值。

### 10.2 Test Condition(测试条件)

| No | ITEM<br>测试项目                                                  | CONDITION<br>条件                        | CRITERION<br>标准                                                                                      |
|----|---------------------------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------|
| 1  | High Temperature<br>Non-Operating Test<br>高温非操作试验             | 80℃*240Hrs                             | .No Defect Of<br>Operational Function In<br>Room Temperature Are<br>Allowable<br>(室温下不允许有操作功<br>能缺陷) |
| 2  | Low Temperature<br>Non-Operating Test<br>低温非操作试验              | -30℃*240Hrs                            |                                                                                                      |
| 3  | High Temperature/Humidity<br>Non Operating Test<br>高温/高湿非操作试验 | 60℃*90%RH*240Hrs                       |                                                                                                      |
| 4  | High Temperature Operating<br>Test<br>高温运行试验                  | 70℃*240Hrs                             | .IDD of LCM in Pre-and<br>Post-Test Should Follow<br>Specification<br>(LCM 在测试前和测试后<br>的 IDD 应遵循规范)  |
| 5  | Low Temperature Operating<br>Test<br>低温运行试验                   | -20℃*240Hrs                            |                                                                                                      |
| 6  | Thermal Shock Test<br>热冲击试验                                   | -20 ℃(30Min)<>70 ℃(30Min)<br>*10CYCLES |                                                                                                      |

#### Notes:

- Judgments should be made after exposure in room temperature for two hours.  
应在室温下暴露两小时后做出判断。
- The distill water is used for the high temperature/humidity test.  
蒸馏水用于高温/湿度试验。
- The sample above is individually for every reliability tests condition.  
上面的样本是针对每种可靠性测试条件单独提供的。

## 11. Precautions (注意事项)

### 11.1 Storage Conditions (储存条件)

- (1) Store the panel or module in a dark place where the temperature is  $23\pm5^{\circ}\text{C}$  and the humidity is below  $45\pm20\%\text{RH}$ . (将面板或模块存放在温度为  $23\pm5^{\circ}\text{C}$ 、湿度低于  $45\pm20\%\text{RH}$  的黑暗处)
- (2) Store in anti-static electricity container. (储存在防静电容器中)
- (3) Store in clean environment, free from dust, active gas, and solvent. (储存在清洁的环境中, 没有灰尘、活性气体和溶剂)
- (4) Do not place the module near organics solvents or corrosive gases. (请勿将模块放置在有机溶剂或腐蚀性气体附近)
- (5) Do not crush, shake, or jolt the module. (请勿挤压、摇晃或震动模块)

### 11.2 Handling Precautions (处理注意事项)

- (1) Avoid static electricity, which can damage the CMOS LSI. (避免静电, 因为静电会损坏 CMOS LSI)
- (2) The polarizing plate of the display is very fragile, please handle if very carefully. (LCM 上的偏振片非常脆弱, 请小心处理)
- (3) Do not give external shock. (不要进行外部电击)
- (4) Do not apply excessive force on the surface. (不要在表面上施加过大的力)
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate. (不要用干布擦拭偏振片, 这样很容易划伤偏振片表面)
- (6) Do not operate it above the absolute maximum rating. (请勿在极限参数以上操作)
- (8) Do not remove the panel or frame from the module. (请勿从模块上拆下面板或框架)