



# LCD Module SPECIFICATION

## 液晶显示模组规格书

|                     |                |
|---------------------|----------------|
| Customer Name 客户名称  | _____          |
| Customer Model 客户机型 | _____          |
| Project Name 机种名    | ENH-TV0096H001 |
| Date 日期             | 2017-9-29      |
| Version 版本          | V1.0           |

### Preliminary Specification

### Final Specification

Customer' s Acceptance 客户承认：

This module uses RoHS material. 模块使用环保材料.

| Comment 承认意见 | Approved by 承认人 |
|--------------|-----------------|
|              |                 |

| Written by 撰写 | Checked by 审核 | Approved by 批准 |
|---------------|---------------|----------------|
| 研发部           | 研发部           | 总经理            |
|               |               |                |



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SHENZHEN ENRICH ELECTRONICS CO.,LTD

## Revision Record

修改记录

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|               |            |                   |



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### 1. General Specifications 基本规格

| No. | Item 项目                    | Specification 规格         | Unit 单位 | Remark |
|-----|----------------------------|--------------------------|---------|--------|
| 1   | LCD Size 液晶面板尺寸            | 0.96                     | inch    | -      |
| 2   | Panel Type 面板类型            | IPS                      | -       | -      |
| 3   | Resolution 分辨率             | 80xRGBx160               | Pixel   | -      |
| 4   | Display Mode 显示模式          | Normally Black           | -       | -      |
| 5   | Number of Colors 颜色数量      | 262K                     | -       | -      |
| 6   | Viewing Direction 使用视角     | free                     | -       | Note1  |
| 7   | NTSC 色彩饱和度                 | 50%                      | -       | Typ.   |
| 8   | Contrast Ratio 对比度         | 600                      | -       | Min.   |
| 9   | Luminance 亮度               | 120                      | cd/m2   | Typ.   |
| 10  | Module Size 模组尺寸           | 13.3(H)*27.95(V)*1.38(D) | mm      | Note1  |
| 11  | Panel Active Area 可视区域     | 10.8*21.7                | mm      | Note1  |
| 12  | Pixel Pitch 像素尺寸           | 0.135*0.1356             | mm      | -      |
| 13  | Pixel Arrangement 像素排列     | RGB-stripe               |         | -      |
| 14  | Weight 重量                  | TBD                      | g       | -      |
| 15  | Driver IC 驱动芯片             | ST7735S                  | -       | -      |
| 16  | Driver IC RAM Size 记忆体     |                          | bit     | -      |
| 17  | Light Source 背光源           | 1 white LEDs             | -       | -      |
| 18  | Interface 接口方式             | 4 SPI                    | -       | -      |
| 19  | Operating Temperature 工作温度 | -20~+70                  | °C      | -      |
| 20  | Storage Temperature 存储温度   | -30~+80                  | °C      | -      |



Note 1: Please refer to the mechanical drawing ; 注 1 : 请参照模组图 ;

## 2. Pin Assignments 接口定义

| Pin No.<br>Pin 序号 | Symbol 符号 | Function 功能描述   |
|-------------------|-----------|---|
| 1                 | TP0       | TP interface  |
| 2                 | TP1       | TP interface  |
| 3                 | SDA       | Serial data input pin in serial interface operation 串行数据输入/输出引脚。  |
| 4                 | SCL       | Serial interface clock 串行时钟引脚。                                    |
| 5                 | RS        | Register select signal. 0:index register; 1:data register。注册选择信号。 |
| 6                 | RESET     | Chip reset signal 复位。   |
| 7                 | CS        | Chip select pin 片选信号。   |
| 8                 | GND       | Ground 接地。  |
| 9                 | NC        | 空脚  |
| 10                | VCC(2.8V) | Analog Power Supply for LCM ( 2.8V ) 系统输入电压 2.8V。                 |
| 11                | LED-      | Backlight cathode 背光负极输入端。  |
| 12                | LED+      | Backlight anode 背光正极输入端。  |
| 13                | GND       | Ground 接地。  |

## 3. Electrical Specification 电气特性

### 3.1 Absolute Maximum Ratings 极限参数

| Item 项目                                | Symbol | Value     | Unit | Remark |
|--|--------|-----------|------|--------|
| Analog Power Supply Voltage<br>模拟供电电压  | VCI    | -0.3~+4.6 | V    | -      |
| Digital Power Supply Voltage<br>数字电源电压 | VDD    | -0.3~+4.6 | V    | -      |
| I/O Power Supply Voltage<br>I/O端口供电电压  | IOVCC  | -0.3~4.6  | V    | -      |

### 3.2 Typical Operation Conditions 典型工作条件



| Item 项目                          | Symbol   | Min.最小            | Typ.典型  | Max.最大            | Unit |
|----------------------------------|----------|-------------------|---------|-------------------|------|
| Analog Supply Voltage<br>模拟供电电压  | VCI      | 2.4               | 2.8     | 3.3               | V    |
| Digital Supply Voltage<br>数字电源电压 | VDD      | 2.4               | 2.8     | 3.3               | V    |
| I/O Supply Voltage<br>接口电压       | IOVCC    | 1.65              | 1.8/2.8 | 3.3               | V    |
| Input High Voltage<br>输入高电平      | $V_{IH}$ | $0.7 \cdot IOVCC$ | -       | IOVCC             | V    |
| Input Low Voltage<br>输入低电平       | $V_{IL}$ | 0                 | -       | $0.3 \cdot IOVCC$ | V    |
| Output High Voltage<br>输出高电平     | $V_{OH}$ | $0.8 \cdot IOVCC$ | -       | -                 | V    |
| Output Low Voltage<br>输出低电平      | $V_{OL}$ | -                 | -       | $0.2 \cdot IOVCC$ | V    |

### 3.3 Backlight Circuit Characteristics 背光功耗

| Item                 | Symbol   | Min. | Typ. | Max. | Unit |
|----------------------|----------|------|------|------|------|
| LED Current 背光电流     | $I_B$    | -    | 15   | -    | mA   |
| LED Voltage 背光电压     | $V_f$    | -    | 3.2  | 3.3  | V    |
| Power Consumption 功耗 | $P_{BL}$ | -    | -    | -    | mW   |

### 3.4 LCD Current Consumption 液晶面板功耗

| Item           | Symbol | Typ. | Max. | Unit |
|----------------|--------|------|------|------|
| Full Mode 正常模式 | VCI    | -    | -    | mA   |

测试条件：VCI=2.8V，IOVCC=2.8V；

Interface 驱动类型：行翻转或者列翻转；

TN Type=>All Black Pattern. TN型液晶面板=>黑色画面；

IPS Type=>All White Pattern. IPS型液晶面板=>白色画面；

Temperature：25℃；温度：室温25摄氏度；



|                 |     |   |   |    |
|-----------------|-----|---|---|----|
| Sleep Mode 休眠模式 | VCI | - | - | uA |
|-----------------|-----|---|---|----|

测试条件：VCI=2.8V，IOVCC=2.8V；  
 DC/DC converter is enabled. Internal oscillator is started and panel scanning is started.  
 除IC内部晶振和面板扫描外，其他功能都暂停工作；  
 Temperature：25°C；温度：室温25摄氏度；

### 4. Optical Specification 光学参数

#### 4.1 LCM Optical Characteristics 液晶模组光学特性

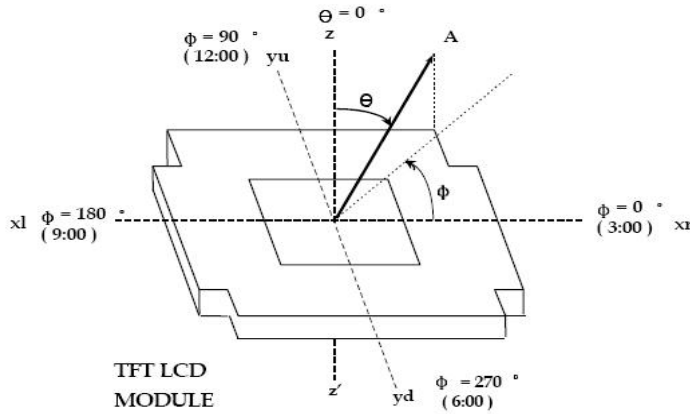
| Item                                   | Symbol   | Condition                 | Min.                                | Typ.  | Max.  | Unit              |        |
|--|----------|---------------------------|-------------------------------------|-------|-------|-------------------|--------|
| Viewing Angle Range<br>视角              | Left     | $\theta_L$                | CR $\geq$ 10                        | -     | 80    | -                 | degree |
|  | Right    | $\theta_R$                |                                     | -     | 80    | -                 |        |
|  | Top      | $\theta_T$                |                                     | -     | 80    | -                 |        |
|  | Bottom   | $\theta_B$                |                                     | -     | 80    | -                 |        |
| Response Time<br>响应时间                  | Ton+Toff | $\theta = \Phi = 0^\circ$ | -                                   | 30    | 40    | ms                |        |
| Contrast Ratio<br>对比度                  | CR       | $\theta = \Phi = 0^\circ$ | -                                   | 800   | -     | -                 |        |
| Luminance 亮度                           | L        | $\theta = \Phi = 0^\circ$ | -                                   | 400   | -     | cd/m <sup>2</sup> |        |
| Color Chromaticity<br>(CIE1931)<br>色坐标 | White    | $W_x$                     | Normal<br>$\theta = \Phi = 0^\circ$ | -0.02 | 0.306 | +0.02             | -      |
|  |          | $W_y$                     |                                     |       | 0.327 |                   |        |
|  | Red      | $R_x$                     |                                     |       | 0.610 |                   |        |
|  |          | $R_y$                     |                                     |       | 0.333 |                   |        |
|  | Green    | $G_x$                     |                                     |       | 0.281 |                   |        |
|  |          | $G_y$                     |                                     |       | 0.533 |                   |        |
|  | Blue     | $B_x$                     |                                     |       | 0.146 |                   |        |
|  |          | $B_y$                     |                                     |       | 0.138 |                   |        |
| Uniformity 均匀度                         | $U_L$    | $\theta = \Phi = 0^\circ$ | 80                                  | -     | -     | %                 |        |



|            |   |   |            |   |
|------------|---|---|------------|---|
| Flicker 闪烁 | - | - | No Visible | - |
|------------|---|---|------------|---|

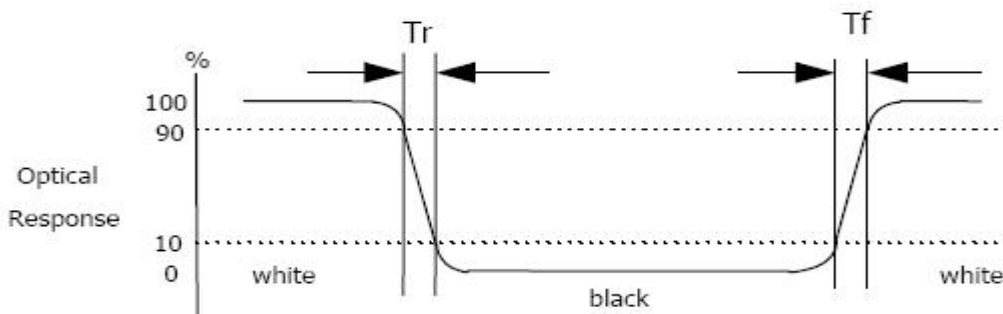
### 4.2 Measurement system 测量系统

#### 4.2.1 LCM Viewing Angle



Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.

#### 4.2.2 Response time



Response time is the time required for the display to transition from white to black (Rising time,  $T_r$ ) and from black to white (Falling time,  $T_f$ ) for additional information.

#### 4.2.3 Contrast Ratio (CR)

Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white.





### 6. Reliability Test Items 可靠性测试项目

| Test Item 测试项目                       | Test Condition 测试条件  | Test result determinant gist 实验结果判定   |
|--------------------------------------|--|---|
| High temperature storage<br>高温存储     | 80±3°C , 24H ;   | Inspection after 2~4hours storage at room temperature,<br>the sample shall be free from defects:<br>试验结束后,已测试的LCD样品必须在室内正常温湿度环境下放置2~4个小时以上才能进行功能和外观检查,样品不允许有以下缺陷:<br>1.Air bubble in the LCD; 模块中有气泡;<br>2.Non-display; 不显示;<br>3.Glass crack; 玻璃破碎;<br>4. The electrical characteristics requirements shall be satisfied.<br>需要满足模块电气性能。 |
| Low temperature storage<br>低温存储      | -30±3°C , 24H ;  |   |
| High temperature operation<br>高温运行测试 | 70±3°C , 24H ;   |   |
| Low temperature operation<br>低温运行测试  | -20±3°C , 24H ;  |   |
| High temperature /humidity<br>高温高湿   | 60°C±3°C,90%±3%RH , 24H ;  |   |
| Thermal Shock<br>冷热冲击                | -30°C/0.5h~ +80°C/0.5h for a total 24 cycles ;   |   |
| Vibration Test<br>振动测试               | Frequency 10Hz~55Hz~10Hz Amplitude : 1.5mm, X , Y , Z direction for total 1H ; (Packing condition) |   |
| ESD test<br>静电测试                     | ±2KV, Human Body Mode, 150pF/330Ω ; ±8KV, Air Mode, 150pF/330Ω ;                                   |   |

Remark: 注意 :

1. The test samples should be applied to only one test item.

每个被测试的模块只能用于其中的一个测试项目。

2. Sample size for each test item is 2pcs.

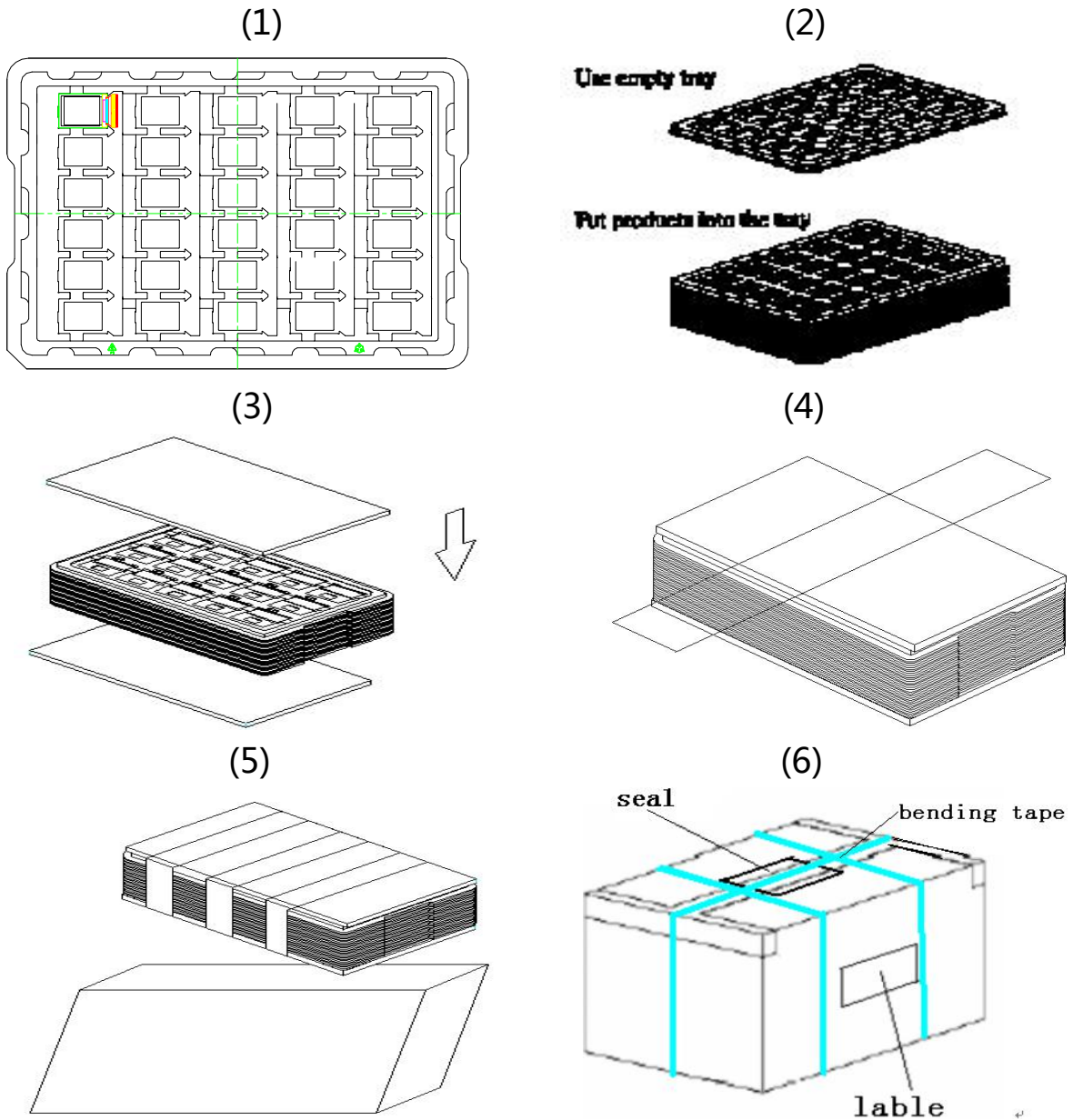
每个测试项目的样品数量为2片。

3. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

故障判断标准:基本规格,电气特性,机械特性,光电特性。

### 7. Packing and Storage Specification(Reference Only) 包装存储

#### 7.1 Packing Method 包装方法



1. Put module into tray cavity. 把模块放进托盘.
2. Tray stacking. 托盘叠装.
3. Put 1 foam under the tray stack and 1 foam above. 在托盘上下放卡板.
4. Fix the cardboard to the tray stack with adhesive tape. 绑胶带.
5. Put the tray stack into carton. 把邦好的托盘放进纸箱.
6. Carton sealing with adhesive tape. 封纸箱.



### 7.2 Storage Method 存储方法

1.Store in an ambient temperature of  $23^{\circ}\text{C}\pm 5^{\circ}\text{C}$ , and in a relative humidity of  $55\%\pm 15\%$ . Don't exceed 12 months and expose to sunlight or fluorescent light.

存储环境温度为  $23\pm 5^{\circ}\text{C}$ ，相对湿度为  $55\%\pm 15\%$ ，存储不能超过 12 个月，不要长时间暴晒。

2. Store in a clean environment, free from dust, active gas, and solvent.

存储在一个干净的环境，不受灰尘，活性气体和溶剂污染。

3. Store in antistatic container.

存储在防静电环境。

### 8. Announcements 注意事项

1.Do not attempt to disassemble or process the LCD module.

请勿拆卸液晶显示模块。

2.Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

不要在印制电路板上钻额外的孔，修改形状或更改印制线路板上元件的位置。

3.Except for soldering the interface, do not make any alterations or modifications with a soldering iron; Ensure welding temperature at  $320^{\circ}\text{C}$  to  $350^{\circ}\text{C}$ , the welding time control within the 10 s, welding note don't stay too long in the same place to avoid scald FPC.

除焊接接口外，不要用烙铁做任何更改；焊接温度保证在  $320^{\circ}\text{C}$ - $350^{\circ}\text{C}$ ，焊接时间控制在 10S 以内，焊接时注意不要在同一处停留时间太久以免烫伤 FPC。

4. Other matters in not clear before use, please contact our staff to guide.

其他事项在不清楚使用之前，请联系我司人员指导进行。

-END-