



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

# HMT043ATA-2C

## LCD Module User Manual

|  |                                  |                                   |
|--|----------------------------------|-----------------------------------|
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|--|----------------------------------|-----------------------------------|

| Rev. | Descriptions                | Release Date |
|------|-----------------------------|--------------|
| 0.1  | - Preliminary Draft release | 2017-08-14   |
| 0.2  | - Update section 3.1        | 2017-08-21   |
|      |                             |              |
|      |                             |              |
|      |                             |              |
|      |                             |              |

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# 1 Basic Specification

TOPWAY HMT043ATA-2C is a Smart TFT Module with 32bit MCU on board. Its graphics engine provides numbers of outstanding features. It supports TOPWAY TML 3.0 (Editor 2017) for preload and pre-design display interface that simplify the host operation and development time. Suitable for industry control, instrumentation, medical electronics, power electric equipment applications.

## 1.1 General Specification

|                         |   |
|-------------------------|---|
| Screen Size(Diagonal) : | 4.3"  |
| Resolution :            | 480(RGB) x 272  |
| Color Depth :           | 65k color (16bit)   |
| Pixel Configuration :   | RGB Stripe  |
| Display Mode :          | Transmissive / Normal White   |
| Viewing Direction :     | 12H(*1)(gray-scale inverse)<br>6H(*2)                               |
| Outline Dimension :     | 121.9 x 74.7 x 14.1 (max)(mm)<br>(see attached drawing for details) |
| Active Area :           | 95.04 x 53.86 (mm)  |
| Backlight :             | LED   |
| Command I/F:            | RS-232C   |
| Project Download:       | by PC   |
| Operating Temperature : | -20 ~ +70°C   |
| Storage Temperature :   | -30 ~ +80°C   |

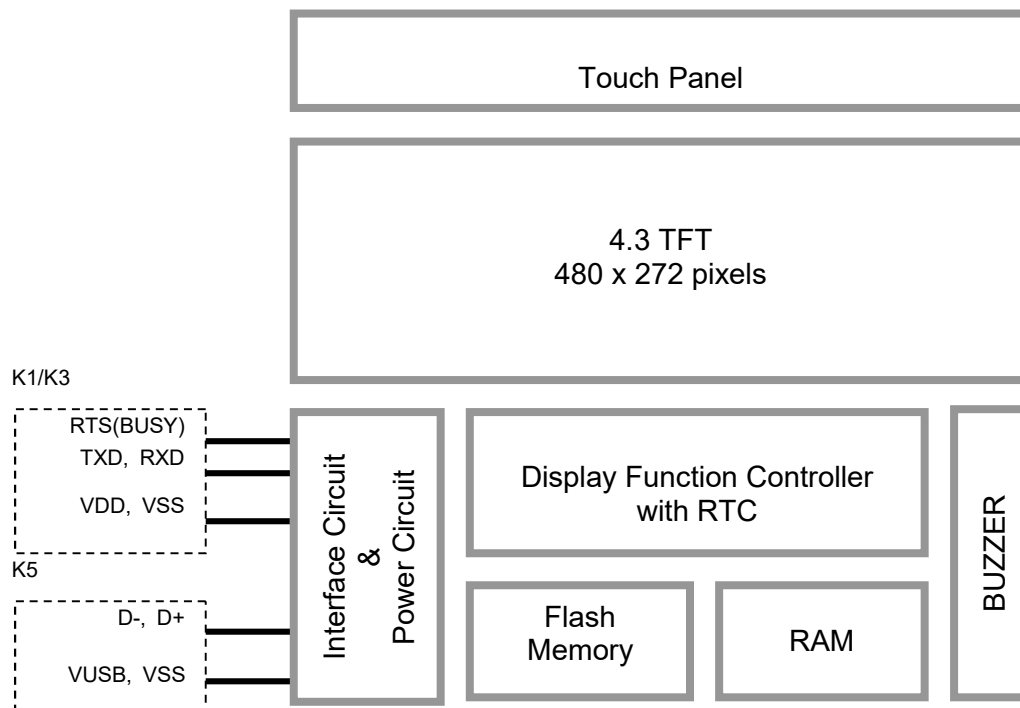
Note:

\*1. For saturated color display content (eg. pure-red, pure-green, pure-blue, or pure-colors-combinations).

\*2. For "color scales" display content.

\*3. Color tone may slightly change by Temperature and Driving Condition.

## 1.2 Block Diagram



## 1.3 Terminal Function

### 1.3.1 RS232 Interface Terminal (K1/K3)

| Pin No.  | Pin Name  | I/O | Descriptions  |
|----------|-----------|-----|---|
| 1, 2, 3  | VDD       | P   | Power supply  |
| 4        | NC        | --  | No connection, leave open   |
| 5        | RX        | I   | Data Input<br>(eg. to PC's RS232C pin3 <9pin D-connector>)  |
| 6        | TX        | O   | Data output<br>(eg. to PC's RS232C pin2 <9pin D-connector>)   |
| 7        | RTS(BUSY) | O   | Request To Send (could function as busy BUSY signal)<br>(eg. to PC's RS232C pin8 <9pin D-connector> ) |
| 8, 9, 10 | VSS       | P   | Ground, (0V)  |

Note.

- \*1. User data and commands transfer through this terminal.
- \*2. HOST using command hand shake during communication is suggested.

### 1.3.2 USB Interface Terminal (K5)

| Pin No. | Pin Name | I/O | Descriptions              |
|---------|----------|-----|---------------------------|
| 1       | VUSB     | P   | Power supply (5V)         |
| 2       | D-       | I/O | USB DATA negative signal  |
| 3       | D+       | I/O | USB DATA positive signal  |
| 4       | NC       | --  | No connection, leave open |
| 5       | VSS      | P   | Ground, (0V)              |

Note.

- \*1. TML files and image files preload through this terminal
- \*2. Standard "USB-drive" functions provided
- \*3. During the files transfer, all others display functions will be suspended
- \*4. R43 = 27R, R45 = 27R, R49 = NC, R50 = NC;  
C37 = 5pF, C39 = 5pF, C40 = NC, C45 = NC; (default)
- \*5. R43 = NC, R45 = NC, R49 = 27R, R50 = 27R;  
C37 = NC, C39 = NC, C40 = 5pF, C45 = 5pF;

## 2 Absolute Maximum Ratings

| Items                 | Symbol   | Min. | Max. | Unit | Condition       |
|-----------------------|----------|------|------|------|-----------------|
| Power Supply voltage  | $V_{dd}$ | -0.3 | 5.5  | V    |                 |
| Operating Temperature | $T_{OP}$ | -20  | 70   | °C   | No Condensation |
| Storage Temperature   | $T_{ST}$ | -30  | 80   | °C   | No Condensation |

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,  $T_{OP}=25^{\circ}\text{C}$
- \*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.

### 3 Electrical Characteristics

#### 3.1 DC Characteristics

VSS=0V, T<sub>OP</sub> =25°C

| Items                   | Symbol           | MIN. | TYP. | MAX.  | Unit | Applicable Pin |
|-------------------------|------------------|------|------|-------|------|----------------|
| Operating Voltage       | V <sub>DD</sub>  | 4.8  | 5.0  | 5.2   | V    | VDD            |
| Rx Input MARK(1)        | V <sub>RxM</sub> | -3.0 | -    | -15.0 | V    | Rx             |
| Rx Input SPACE(0)       | V <sub>RxS</sub> | +3.0 | -    | +15.0 | V    | Rx             |
| Tx Output MARK(1)       | V <sub>TxM</sub> | -3.0 | -    | -15.0 | V    | Tx             |
| Tx Output SPACE(0)      | V <sub>TxS</sub> | +3.0 | -    | +15.0 | V    | Tx             |
| RTS Output High         | V <sub>TxH</sub> | -3.0 | -    | -15.0 | V    | RTS(BUSY)      |
| RTS Output Low          | V <sub>TxL</sub> | +3.0 | -    | +15.0 | V    | RTS(BUSY)      |
| Operating Current       | IDD              | -    | 295  | -     | mA   | VDD (*1)       |
| Operating Current (USB) | IVUSB            | -    | 160  | -     | mA   | VUSB           |
| Battery Supply current  | IBAT             | -    | 0.6  | -     | uA   | (*2)           |

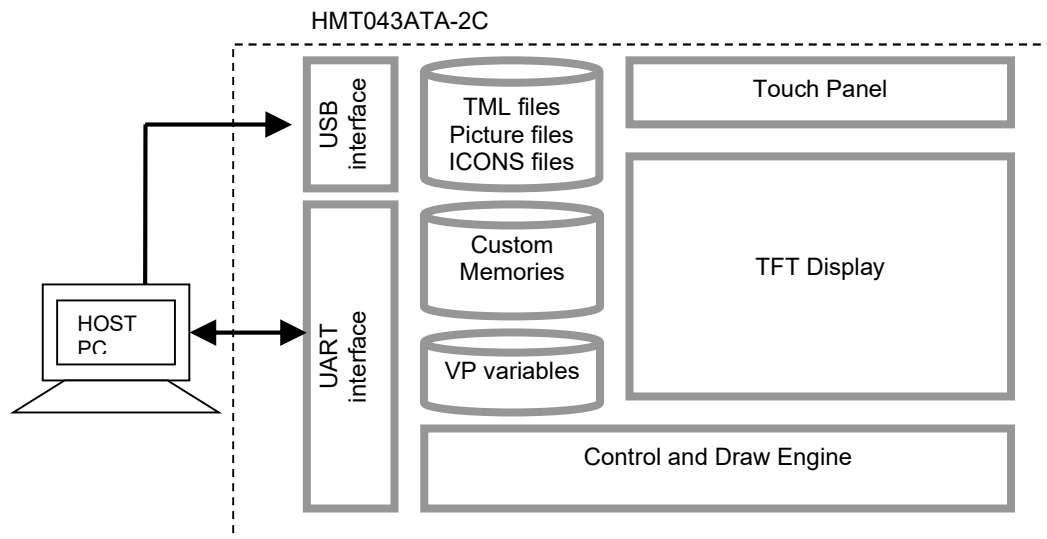
Note.

\*1. Normal display condition.

\*2. For Battery driving RTC application, RTC configuration should be enabled in the project global setting. And after install/re-install the battery, it should be power-on once for correct RTC configurations.

## 4 Function Specifications

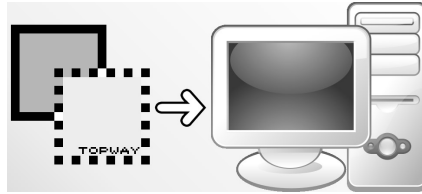
### 4.1 Basic Operation Function Descriptions



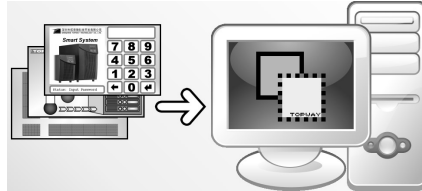
- TML files, Picture files, ICON files are stored inside FLASH memory area. They are preloaded to HMT043ATA-2C for stand alone interface use.
- Those files are preloaded via USB interface as an USB drive.
- All the interface flow and the touch response are based on the preloaded TML files
- VP variables memory is inside RAM area, it provides real time access via UART by the HOST or display onto the TFT by TML file.
- Custom Memories are inside FLASH memory area. It can be accessed via UART interface by the HOST.
- Control and Draw Engine executes HOST commands and response respectively
- It also reports the real time Touch Key number to the HOST

**4.2 Quick Start Guide**

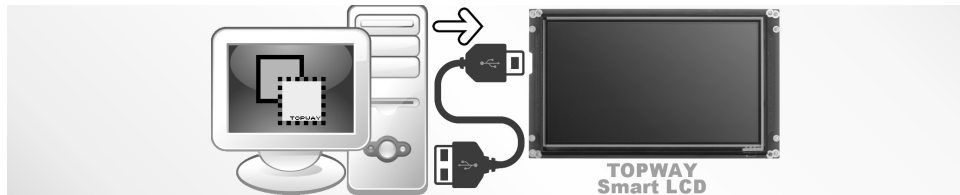
- 1. Install TOPWAY Graphics Editor



- 2. Import pictures design UI flow



- 3. Download to Smart LCD



- 4. power on & display



- 5. Connect to host Show real time data



**4.3 Command Descriptions**

Please refer to "SMART LCD Command Manual" .

**5 Optical Characteristics**

| Item                  | Symbol           | Condition | Min                | Typ   | Max   | Unit              | Remark   |
|-----------------------|------------------|-----------|--------------------|-------|-------|-------------------|----------|
| <b>View Angles</b>    | θT               | CR ≧ 10   | 70                 | 80    | -     | Degree            | Note2,3  |
|                       | θB               |           | 50                 | 60    | -     |                   |          |
|                       | θL               |           | 70                 | 80    | -     |                   |          |
|                       | θR               |           | 70                 | 80    | -     |                   |          |
| <b>Contrast Ratio</b> | CR               | θ=0°      | 700                | 900   | -     |                   | Note 3   |
| <b>Response Time</b>  | T <sub>ON</sub>  | 25°C      | -                  | 20    | 30    | ms                | Note 4   |
|                       | T <sub>OFF</sub> |           |                    |       |       |                   |          |
| <b>Chromaticity</b>   | <b>White</b>     | x         | Backlight is<br>on | 0.255 | 0.305 | 0.355             | Note 1,5 |
|                       |                  | y         |                    | 0.277 | 0.327 | 0.377             |          |
|                       | <b>Red</b>       | x         |                    | 0.534 | 0.584 | 0.634             | Note 1,5 |
|                       |                  | y         |                    | 0.300 | 0.350 | 0.400             |          |
|                       | <b>Green</b>     | x         |                    | 0.290 | 0.340 | 0.390             | Note 1,5 |
|                       |                  | y         |                    | 0.543 | 0.593 | 0.643             |          |
|                       | <b>Blue</b>      | x         |                    | 0.102 | 0.152 | 0.202             | Note 1,5 |
|                       |                  | y         |                    | 0.040 | 0.090 | 0.140             |          |
| <b>Uniformity</b>     | U                |           | 75                 | 80    | -     | %                 | Note 6   |
| <b>NTSC</b>           |                  |           | 45                 | 50    | -     | %                 | Note 5   |
| <b>Luminance</b>      | L                |           | -                  | 320   | -     | cd/m <sup>2</sup> | Note 7   |

1. IF= 40 mA, and the ambient temperature is 25°C.

2. The test systems refer to Note 1 and Note 2.



Note 1:

The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment SR-3A (1°)

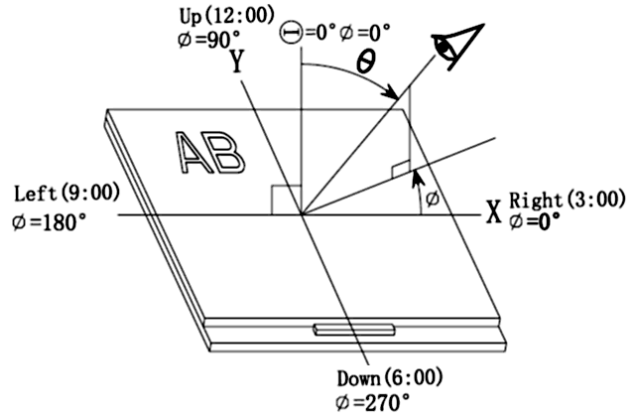
Measuring condition:

- Measuring surroundings: Dark room
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

Note 2:

The definition of viewing angle:

Refer to the graph below marked by  $\theta$  and  $\phi$



Note 3:

The definition of contrast ratio (Test LCM using SR-3A (1°)):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

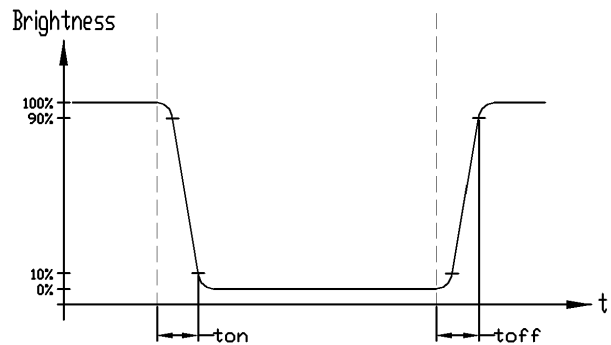
(Contrast Ratio is measured in optimum common electrode voltage)

Note 4:

Definition of Response time. (Test LCD using BM-7A(2°)):

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

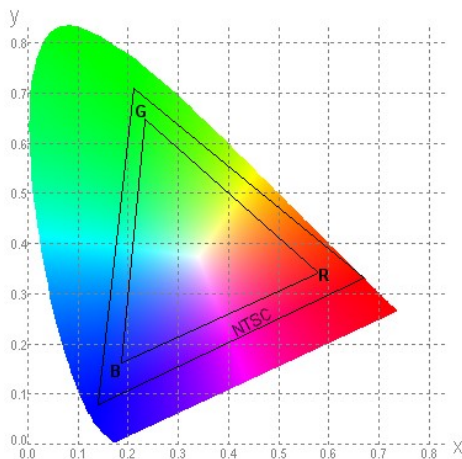


Note 5:

Definition of Color of CIE1931 Coordinate and NTSC Ratio.

Color gamut:

$$S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$



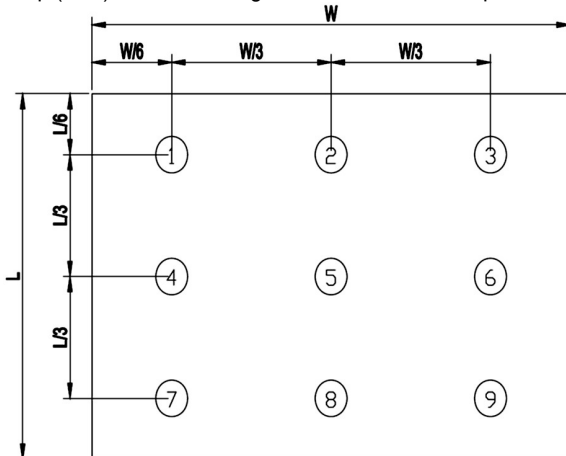
Note 6:

The luminance uniformity is calculated by using following formula.

$$\Delta Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$$

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.



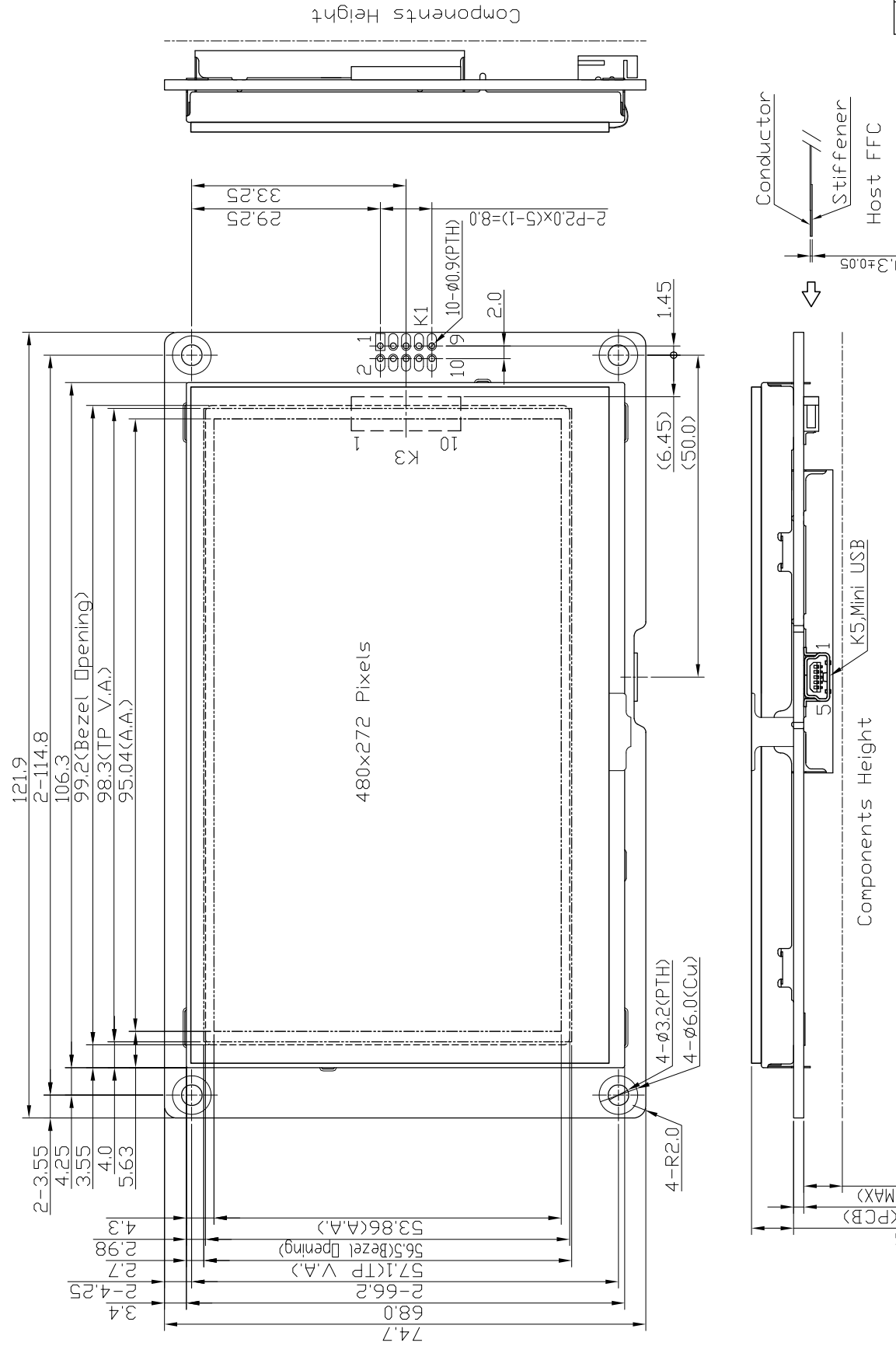
Note 7:

Measured the luminance of white state at center point

## **6 Precautions of using LCD Modules**

Please refer to "LCD-Module-Design-Handling-Precaution.pdf".

| Terminal No. | Pin Name  |
|--------------|-----------|
| 1            | VDD       |
| 2            | VDD       |
| 3            | VDD       |
| 4            | NC        |
| 5            | RX        |
| 6            | TX        |
| 7            | RTS(BUSY) |
| 8            | VSS       |
| 9            | VSS       |
| 10           | VSS       |



- Note:
- \*1. LCD Display Type : TFT, Transmissive
  - \*2. Operating Voltage : 5.0V
  - \*3. Backlight Color : White LEDs
  - \*4. Pixel Arrangement : RGB-STRIFE
  - \*5. Color Depth : 65k Colors
  - \*6. K1/K2 Interface : RS-232C
  - \*7. Touch Panel Type : Resistive Touch Panel
  - \*8. Operating Temperature : -20°C~70°C
  - \*9. Storage Temperature : -30°C~80°C
  - \*10. Foam Gasket must be assemble outside TP VA by 0.5mm

|            |                          |
|------------|--------------------------|
| C          |                          |
| B          |                          |
| A          |                          |
| Rev/Note   | Date                     |
| Dwg Title  | HMT043ATA-2C Outline Dwg |
| Dwg No.    | MK-006128-1-1            |
| Scale      | 3/2                      |
| Tol.       | ±0.5                     |
| Unit       | mm                       |
| Paper Size | A3                       |
| Approved   | Checked                  |
|            | Drawn                    |
|            | Luo Lin                  |

Host FFC Details  
Scale=3/2

**TOPWAY**