

# Shenzhen Leadtek Electronics Co.,Ltd

## PRODUCT SPECIFICATION

### TFT-LCD MODULE

**Module No: LTK050HDHCT13-V0**

☒ Preliminary Specification

☐ Approval Specification

| Designed by                                                                         | Checked by                                                                          | Approved by                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |

#### Final Approval by Customer

| Approved by | Comment |
|-------------|---------|
|             |         |

※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

## Revision Record

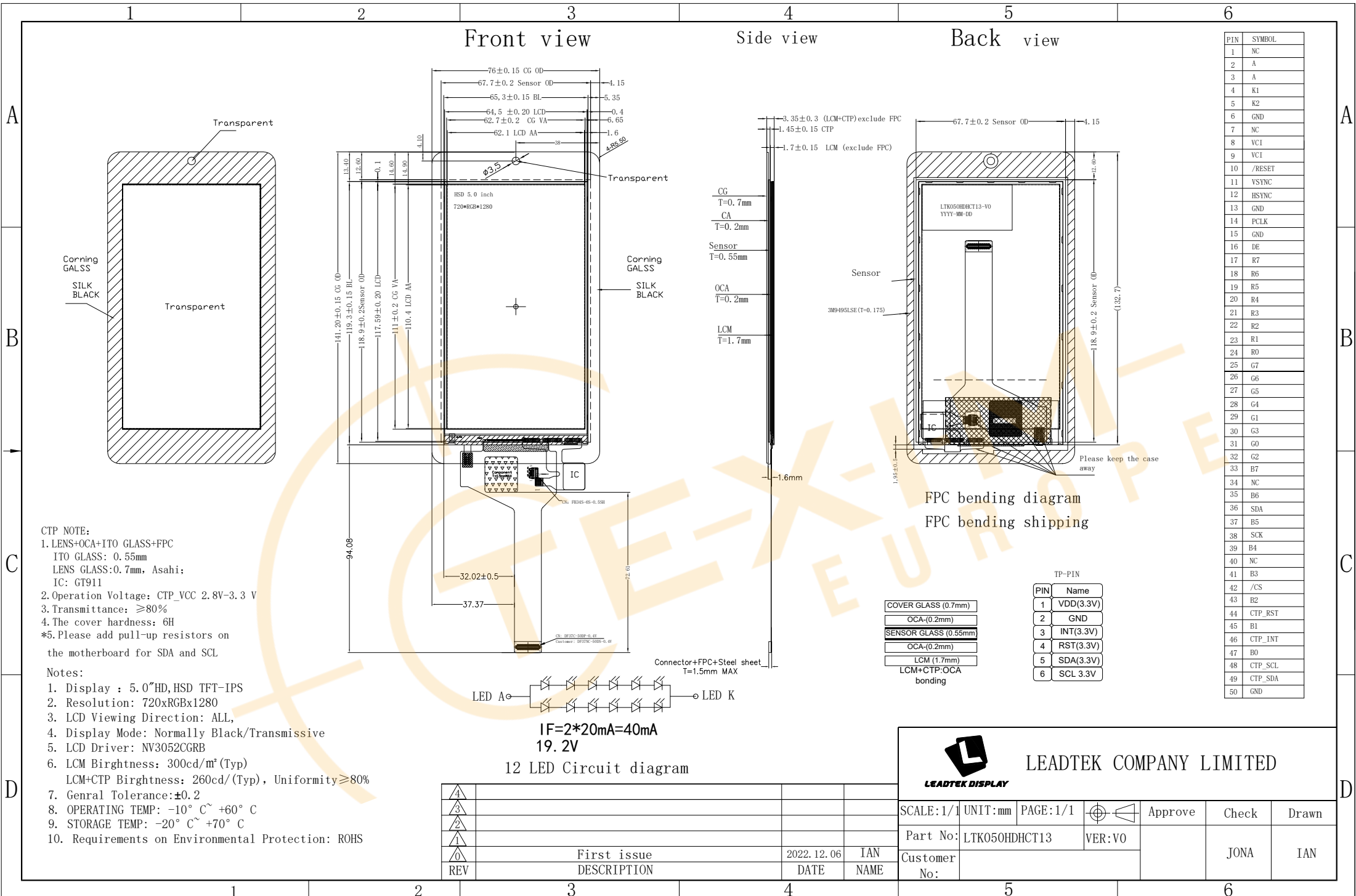
[illegible]

## 1. Numbering System

## 2. TFT General Information

| ITEM                  | STANDARD VALUES                     | UNITS |
|-----------------------|-------------------------------------|-------|
| LCD type              | 5.0" TFT                            | --    |
| Dot arrangement       | 720(RGB) × 1280                     | dots  |
| Color filter array    | RGB vertical stripe                 | --    |
| Display mode          | IPS / Transmissive / Normally Black | --    |
| Viewing Direction     | 80/80/80/80                         | --    |
| TFT Driver IC         | NV3052CGRB                          | --    |
| CTP type              | NC                                  | --    |
| Surface Treatment     | NC                                  | --    |
| CTP Driver IC         | GT911                               | --    |
| Module size           | 76.00(W) × 141.20(H) × 3.35(T)      | mm    |
| Active area           | 62.1(W) × 110.4(H)                  | mm    |
| LENS Viewing area     | NC                                  | mm    |
| Dot pitch             | 0.08625(H) × 0.08625(V)             | mm    |
| Interface             | 3line SPI + 24bit RGB               | --    |
| Operating temperature | -10 ~ +60                           | °C    |
| Storage temperature   | -20 ~ +70                           | °C    |
| Back Light            | 12pcs White LED                     | --    |
| Weight                | TBD                                 | g     |

## 3. Mechanical Drawing



## 4. Interface Description

| PIN NO. | PIN NAME | DESCRIPTION                                         |
|---------|----------|-----------------------------------------------------|
| 1       | NC       | NC                                                  |
| 2       | A        | Power supply for backlight anode input terminal.    |
| 3       | A        | Power supply for backlight anode input terminal.    |
| 4       | K        | Power supply for backlight cathode input terminals. |
| 5       | K        | Power supply for backlight cathode input terminals. |
| 6       | GND      | Ground                                              |
| 7       | NC       | NC                                                  |
| 8       | VCI      | TFT and CTP power supply input.                     |
| 9       | VCI      | TFT and CTP power supply input.                     |
| 10      | /RESET   | Reset signal input terminal, active at 'L'.         |
| 11      | VSYNC    | Vertical Sync Input                                 |
| 12      | HSYNC    | Horizontal Sync Input                               |
| 13      | GND      | Ground                                              |
| 14      | PCLK     | Dot Data Clock                                      |
| 15      | GND      | Ground                                              |
| 16      | DE       | Data Enable Input                                   |
| 17      | R7       | Red data bus.                                       |
| 18      | R6       |                                                     |
| 19      | R5       |                                                     |
| 20      | R4       |                                                     |
| 21      | R3       |                                                     |
| 22      | R2       |                                                     |
| 23      | R1       |                                                     |
| 24      | R0       |                                                     |
| 25      | G7       | Green data bus.                                     |
| 26      | G6       |                                                     |
| 27      | G5       |                                                     |
| 28      | G4       |                                                     |
| 29      | G1       |                                                     |
| 30      | G3       |                                                     |
| 31      | G0       |                                                     |
| 32      | G2       |                                                     |

|    |         |                                |
|----|---------|--------------------------------|
| 33 | B7      | Blue data bus.                 |
| 34 | NC      | NC                             |
| 35 | B6      | Blue data bus.                 |
| 36 | SDA     | SPI Interface Data.            |
| 37 | B5      | Blue data bus.                 |
| 38 | SCL     | SPI Interface Data Clock.      |
| 39 | B4      | Blue data bus.                 |
| 40 | NC      | NC                             |
| 41 | B3      | Blue data bus.                 |
| 42 | /CS     | Chip select signal, Active "L" |
| 43 | B2      | Blue data bus.                 |
| 44 | CTP_RST | CTP reset line.                |
| 45 | B1      | Blue data bus.                 |
| 46 | CTP_INT | CTP interrupt line.            |
| 47 | B0      | Blue data bus.                 |
| 48 | CTP_SCL | CTP I2C clock line.            |
| 49 | CTP_SDA | CTP I2C data line.             |
| 50 | GND     | Ground                         |

## 5. Absolute Maximum Ratings

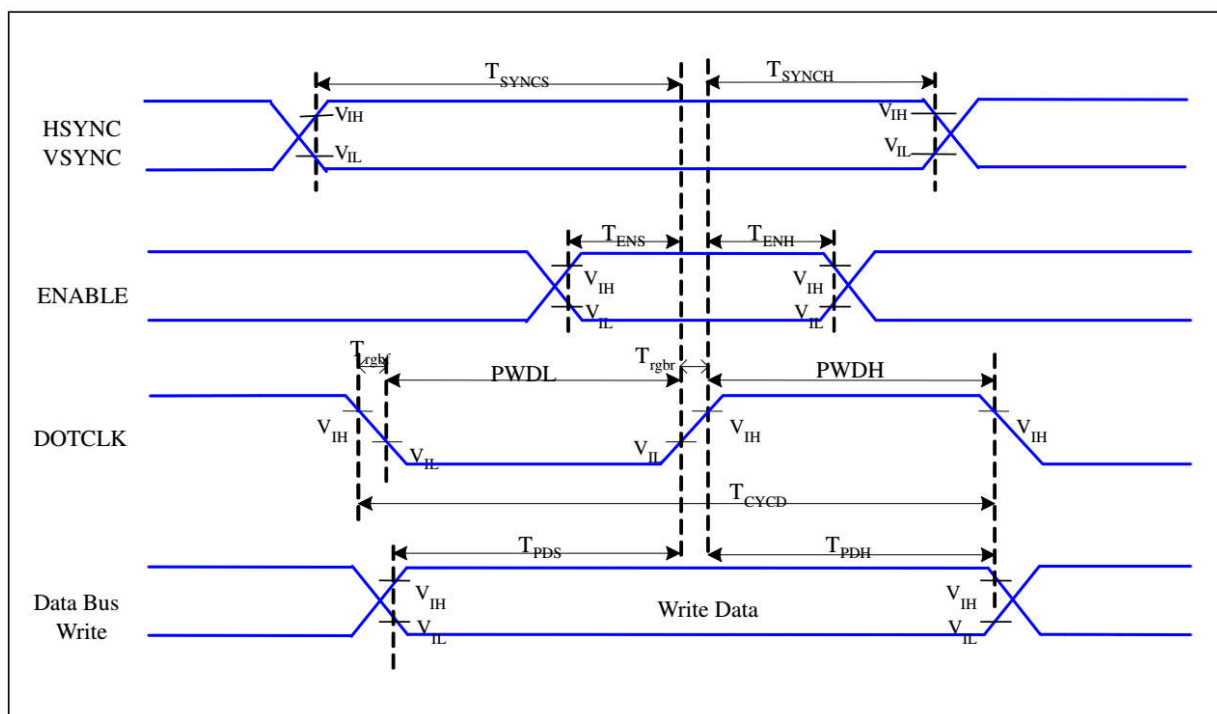
| Item                  | Symbol          | Min. | Max.                 | Unit |
|-----------------------|-----------------|------|----------------------|------|
| Analog Supply Voltage | V <sub>CI</sub> | -0.3 | 3.6                  | V    |
| Input Voltage         | V <sub>in</sub> | -0.3 | V <sub>CI</sub> +0.5 | V    |
| Operating Temperature | T <sub>OP</sub> | -10  | 60                   | °C   |
| Storage Temperature   | T <sub>ST</sub> | -20  | 70                   | °C   |
| Storage Humidity      | HD              | 20   | 90                   | %RH  |

## 6. DC Characteristics

| Item                  | Symbol          | Min.               | Typ. | Max.               | Unit | Remark              |
|-----------------------|-----------------|--------------------|------|--------------------|------|---------------------|
| Analog Supply Voltage | V <sub>CI</sub> | 2.5                | 2.8  | 3.3                | V    | -                   |
| Input High Voltage    | V <sub>IH</sub> | 0.7V <sub>CI</sub> | -    | V <sub>CI</sub>    | V    | Digital input pins  |
| Input Low Voltage     | V <sub>IL</sub> | GND                | -    | 0.3V <sub>CI</sub> | V    | Digital input pins  |
| Output High Voltage   | V <sub>OH</sub> | 0.8V <sub>CI</sub> | -    | V <sub>CI</sub>    | V    | Digital output pins |
| Output Low Voltage    | V <sub>OL</sub> | GND                | -    | 0.2V <sub>CI</sub> | V    | Digital output pins |
| I/O Leak Current      | I <sub>LI</sub> | -1.0               | -    | 1.0                | uA   | -                   |

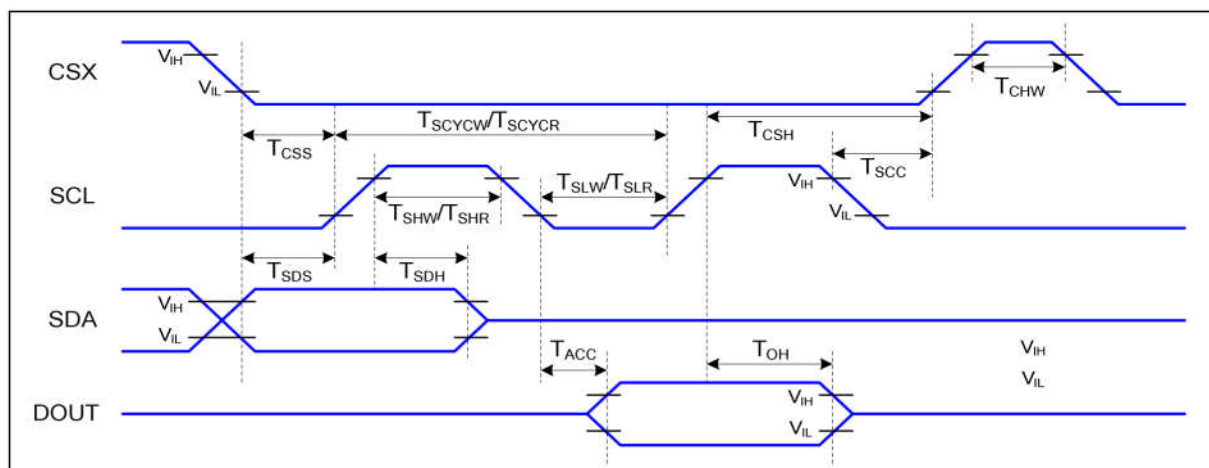
## 7. Timing Characteristics

### 7.1 RGB Interface Characteristics



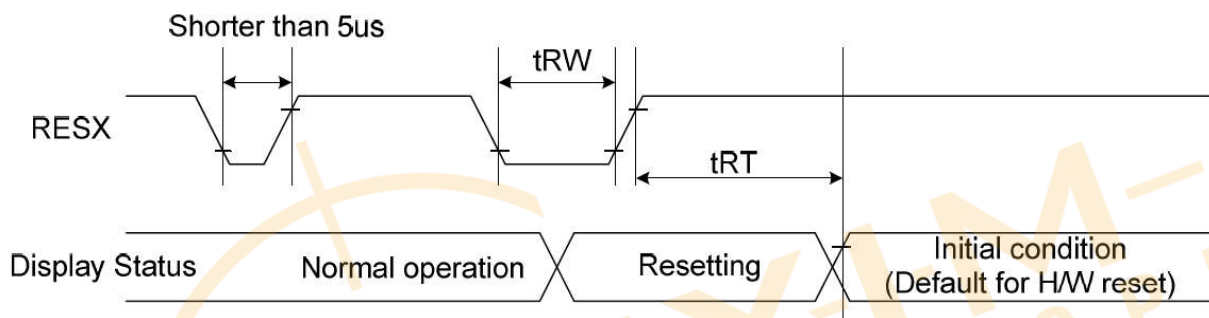
| Signal       | Symbol               | Parameter                     | MIN | MAX | Unit | Description |
|--------------|----------------------|-------------------------------|-----|-----|------|-------------|
| HSYNC, VSYNC | $T_{SYNCS}$          | VSYSNC, HSYNC Setup Time      | 5   | -   | ns   |             |
| ENABLE       | $T_{ENS}$            | Enable Setup Time             | 5   | -   | ns   |             |
|              | $T_{ENH}$            | Enable Hold Time              | 5   | -   | ns   |             |
| DOTCLK       | $PWDH$               | DOTCLK High-level Pulse Width | 15  | -   | ns   |             |
|              | $PWDL$               | DOTCLK Low-level Pulse Width  | 15  | -   | ns   |             |
|              | $T_{CYCD}$           | DOTCLK Cycle Time             | 33  | -   | ns   |             |
|              | $T_{rgbr}, T_{rgbf}$ | DOTCLK Rise/Fall time         | -   | 15  | ns   |             |
| DB           | $T_{PDS}$            | PD Data Setup Time            | 5   | -   | ns   |             |
|              | $T_{PDH}$            | PD Data Hold Time             | 5   | -   | ns   |             |

### 7.2 Serial Interface Characteristics (3-line serial)



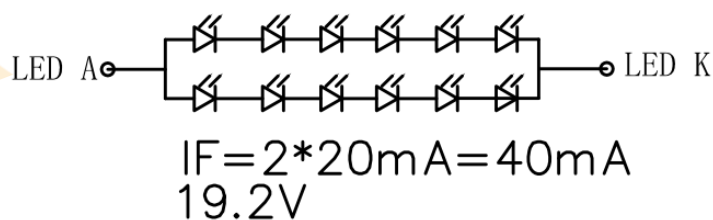
| Signal       | Symbol             | Parameter                      | Min | Max | Unit | Description |
|--------------|--------------------|--------------------------------|-----|-----|------|-------------|
| CSX          | T <sub>CSS</sub>   | Chip select setup time (write) | 15  |     | ns   |             |
|              | T <sub>CSH</sub>   | Chip select hold time (write)  | 15  |     | ns   |             |
|              | T <sub>CSS</sub>   | Chip select setup time (read)  | 60  |     | ns   |             |
|              | T <sub>SCC</sub>   | Chip select hold time (read)   | 60  |     | ns   |             |
|              | T <sub>CHW</sub>   | Chip select "H" pulse width    | 40  |     | ns   |             |
| SCL          | T <sub>SCYCW</sub> | Serial clock cycle (Write)     | 66  |     | ns   |             |
|              | T <sub>SHW</sub>   | SCL "H" pulse width (Write)    | 15  |     | ns   |             |
|              | T <sub>SLW</sub>   | SCL "L" pulse width (Write)    | 15  |     | ns   |             |
|              | T <sub>SCYCR</sub> | Serial clock cycle (Read)      | 150 |     | ns   |             |
|              | T <sub>SHR</sub>   | SCL "H" pulse width (Read)     | 60  |     | ns   |             |
|              | T <sub>SLR</sub>   | SCL "L" pulse width (Read)     | 60  |     | ns   |             |
| SDA<br>(DIN) | T <sub>SDS</sub>   | Data setup time                | 10  |     | ns   |             |
|              | T <sub>SDH</sub>   | Data hold time                 | 10  |     | ns   |             |

### 7.3 Reset Timing Characteristics



| Signal | Symbol | Parameter            | Min | Max                              | Unit |
|--------|--------|----------------------|-----|----------------------------------|------|
| RESX   | tRW    | Reset pulse duration | 10  |                                  | uS   |
|        | tRT    | Reset cancel         |     | 5 (note 1,5)<br>120 (note 1,6,7) | mS   |

### 8. Backlight Characteristics



| Item                       | Symbol | MIN   | TYP  | MAX | UNIT              | Test Condition |
|----------------------------|--------|-------|------|-----|-------------------|----------------|
| Supply Voltage             | Vf     | -     | 19.2 | -   | V                 | If=40mA        |
| Supply Current             | If     | -     | 40   | -   | mA                | -              |
| Luminous Intensity for LCM | -      | -     | 260  | -   | Cd/m <sup>2</sup> | If=40mA        |
| Uniformity for LCM         | -      | 80    | -    | -   | %                 | If=40mA        |
| Life Time                  | -      | 20000 | -    | -   | Hr                | If=40mA        |
| Backlight Color            | White  |       |      |     |                   |                |

## 9. Optical Characteristics

| Item                              |      | Symbol                         | Condition  | Min. | Typ.   | Max. | Unit | Note                                                                 |
|-----------------------------------|------|--------------------------------|------------|------|--------|------|------|----------------------------------------------------------------------|
| Transmittance (with Polarizer)    |      | T (%)                          | $\Theta=0$ | —    | (4.2)  | —    | %    | Measuring with normal polarizer , Reference Only<br>Base on Vop=5.1V |
| Transmittance (without Polarizer) |      | T (%)                          |            | —    | (14.7) | —    | %    |                                                                      |
| Contrast Ratio                    |      | CR                             |            | 640  | 800    | —    | —    | (1)(2)                                                               |
| Response Time                     |      | T <sub>R</sub> +T <sub>F</sub> |            | —    | 25     | 35   | msec | (1)(3)                                                               |
| Color Gamut                       | (%)  |                                |            | 55   | 60     | —    | %    | C-light                                                              |
| Viewing Angle                     | Hor. | $\Theta_L$                     | CR>10      | 70   | 80     | —    | —    | (1)(4)<br>Measuring with normal polarizer , Reference Only           |
|                                   |      | $\Theta_R$                     |            | 70   | 80     | —    |      |                                                                      |
|                                   | Ver. | $\Theta_U$                     |            | 70   | 80     | —    |      |                                                                      |
|                                   |      | $\Theta_D$                     |            | 70   | 80     | —    |      |                                                                      |
| Optima View Direction             |      | Free                           |            |      |        |      |      | (5)                                                                  |

### Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).

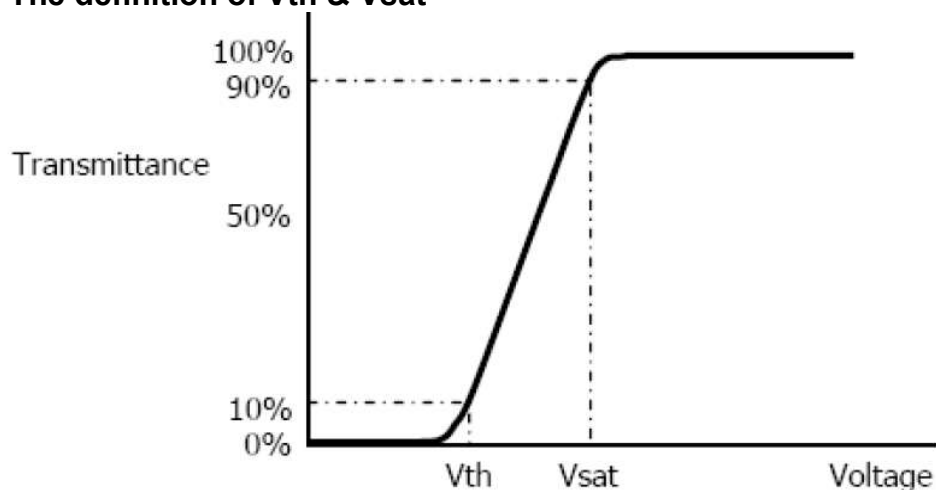
2. Contrast measurements shall be made at viewing angle of  $\Theta=0$  and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically.  $CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$

3. Transmittance is the value with DBEF Polarizer.

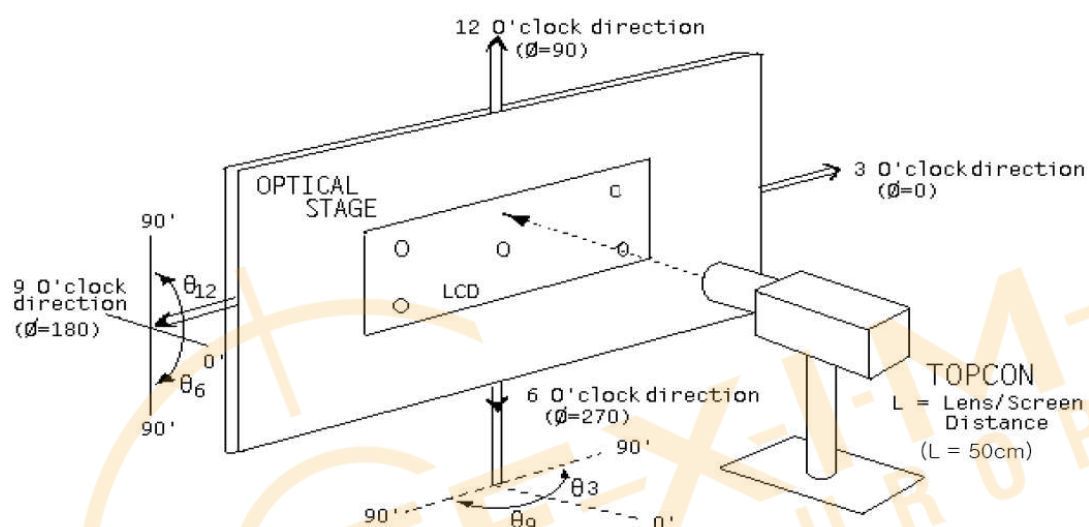
4. The color chromaticity coordinates specified in Table1 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the C/F. Measurement condition is C - light source & Halogen Lamp

5. The electro-optical response time measurements shall be made as FIG.3 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is  $T_r$  , and 90% to 10% is  $T_f$ .

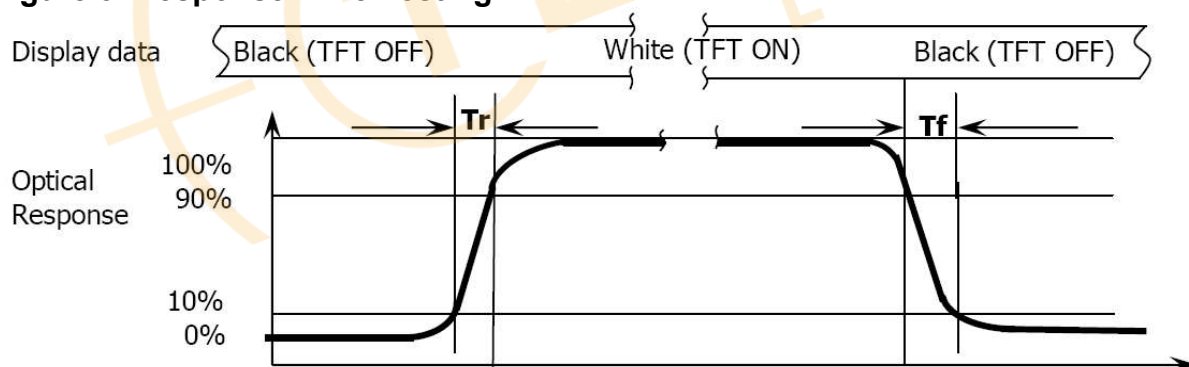
### Figure 1. The definition of $V_{th}$ & $V_{sat}$



### Figure 2. Measurement Set Up



### Figure 3. Response Time Testing



## 10. Reliability Test Conditions And Methods

| NO. | TEST ITEMS                 | TEST CONDITION                                                                                        | INSPECTION AFTER TEST                                                                                                                                                                                                                                                                                                                                                  |
|-----|----------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①   | High Temperature Storage   | 70℃±2℃×96Hours                                                                                        | Inspection after 2~4hours storage at room temperature,the samples should be free from defects:<br>1,Air bubble in the LCD.<br>2,Sealleak.<br>3,Non-display.<br>4,Missing segments.<br>5,Glass crack.<br>6,Current IDD is twice higher than initial value.<br>7,The surface shall be free from damage.<br>8,The electric charateristic requirements shall be satisfied. |
| ②   | Low Temperature Storage    | -20℃±2℃×96Hours                                                                                       |                                                                                                                                                                                                                                                                                                                                                                        |
| ③   | High Temperature Operating | 60℃±2℃×96Hours                                                                                        |                                                                                                                                                                                                                                                                                                                                                                        |
| ④   | Low Temperature Operating  | -10℃±2℃×96Hours                                                                                       |                                                                                                                                                                                                                                                                                                                                                                        |
| ⑤   | Temperature Cycle(Storage) | -10℃ ↔ 25℃ ↔ 60℃<br>(30min) (5min) (30min)<br>1cycle<br>Total 10cycle                                 |                                                                                                                                                                                                                                                                                                                                                                        |
| ⑥   | Damp Proof Test (Storage)  | 50℃±5℃×90%RH×96Hours                                                                                  |                                                                                                                                                                                                                                                                                                                                                                        |
| ⑦   | Vibration Test             | Frequency:10Hz~55Hz~10Hz<br>Amplitude:1.5M<br>X,Y,Z direction for total 3hours<br>(Packing Condition) |                                                                                                                                                                                                                                                                                                                                                                        |
| ⑧   | Drooping Test              | Drop to the ground from 1M height<br>one time<br>every side of carton.<br>(Packing Condition)         |                                                                                                                                                                                                                                                                                                                                                                        |
| ⑨   | ESD Test                   | Voltage:±8KV,R:330Ω,C:150PF,Air Mode,10times                                                          |                                                                                                                                                                                                                                                                                                                                                                        |

### REMARK:

- 1,The Test samples should be applied to only one test item.
- 2,Sample side for each test item is 5~10pcs.
- 3,For Damp Proof Test,Pure water(Resistance > 10MΩ)should be used.
- 4,In case of malfunction defect caused by ESD damage,if it would be recovered to normal state after resetting,it would be judge as a good part.
- 5,EL evaluation should be excepted from reliability test with humidity and temperature:Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- 6,Failure Judgment Criterion:Basic Specification Electrical Characteristic,Mechanical Characteristic,Optical Characteristic.

## 11. Inspection Standard

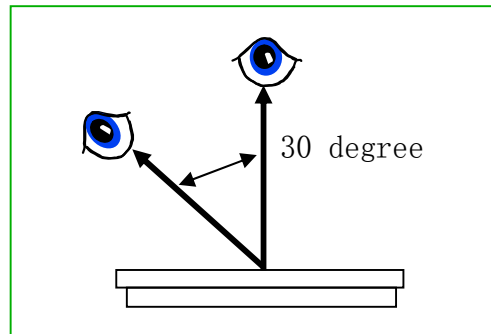
This standard apply to C-STN/TFT module

### 1. Spot check plan:

According to spot check level II ,MIL-STD-105D Level II ,the rank of accept or reject is below:

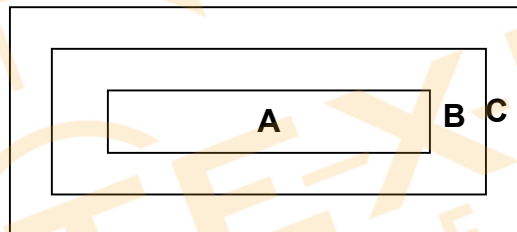
A 级: major non-conformance: AQL 0.65      minor non-conformance: AQL 1.

### 2. Inspection condition:



Under daylight lamp 20~40W, product distance inspector'eye 30cm,incline degree 30°.

### 3. LCD area define:



Area A: display area

Area B: VA area

Area C: out of VA area,not in sight after assembly

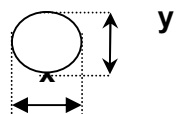
Remark :non-conformance at area C,but is OK that isn't influence reliability of product & assembly by customer.

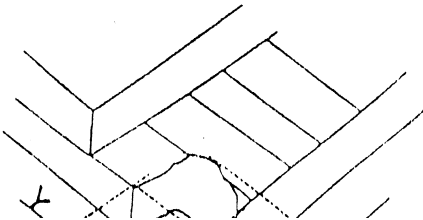
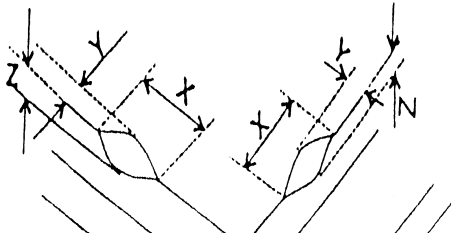
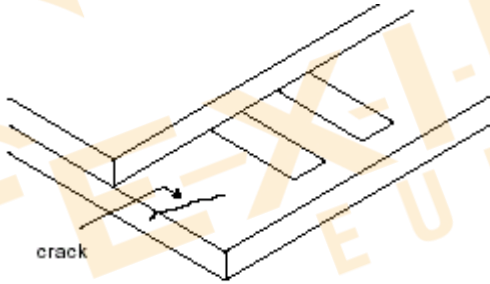
## 4. Inspection standard

### 4.1 Major non-conformance

| NO.   | Item                     | Inspection standard                                                                                                      | Rate  |
|-------|--------------------------|--------------------------------------------------------------------------------------------------------------------------|-------|
| 4.1.1 | Function non-conformance | 1) No display, display abnormaly<br>2) Miss line, short<br>3) B/L no function or function abnormaly<br>4) TP no function | major |
| 4.1.2 | miss                     | No matter miss what component                                                                                            |       |
| 4.1.3 | Out of size              | Module dimension out of spec                                                                                             |       |

### 4.2 Appearance non-conformance

| NO.                                                     | Item                           | Inspection standard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Rate                 |                                |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|---------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------|-------------------|--------|-------------------|---|---|-----------|------------------|--------|---|--------|-------------------------|---------------|--------|-------------------------|--------|--------------|-------------------------|---|--|---------------|----------------------|---|--|--|------------|--------------------------------|--|
| 4.2.1                                                   | Black or white spot (power on) | <div>dot non-conformance define <math>\Phi</math></div> <div> <math display="block">\Phi = \frac{(x + y)}{2}</math>  </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Minor                |                                |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | <div>A grade</div> <table> <tr> <th rowspan="2">area<br/>size (mm)</th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> <tr> <td><math>\Phi \leq 0.10</math></td> <td colspan="2">ignore</td> <td rowspan="5">ignore</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.15</math></td> <td colspan="2">3</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.20</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td colspan="2">1</td> </tr> <tr> <td><math>0.25 &lt; \Phi</math></td> <td colspan="2">0</td> </tr> </table>                                                        |                      | area<br>size (mm)              | Most approve q'ty |        |                   | A | B | C         | $\Phi \leq 0.10$ | ignore |   | ignore | $0.10 < \Phi \leq 0.15$ | 3             |        | $0.15 < \Phi \leq 0.20$ | 2      |              | $0.20 < \Phi \leq 0.25$ | 1 |  | $0.25 < \Phi$ | 0                    |   |  |  |            |                                |  |
|                                                         |                                | area<br>size (mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |                                | Most approve q'ty |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      | A                              | B                 | C      |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $\Phi \leq 0.10$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      | ignore                         |                   | ignore |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $0.10 < \Phi \leq 0.15$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      | 3                              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $0.15 < \Phi \leq 0.20$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      | 2                              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $0.20 < \Phi \leq 0.25$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      | 1                              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $0.25 < \Phi$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      | 0                              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | Most approve 4 damages, dot to dot $\geq 10\text{mm}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                                |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
| 4.2.2                                                   | Black or white line (power on) | <div>A grade</div> <table> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Most approve q'ty</th> </tr> <tr> <th>L(length)</th> <th>W(width)</th> <th>A</th> <th>B</th> <th>C</th> </tr> <tr> <td>ignore</td> <td><math>W \leq 0.03</math></td> <td colspan="2">ignore</td> <td rowspan="4">ignore</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.05 &lt; W \leq 0.07</math></td> <td colspan="2">1</td> </tr> <tr> <td></td> <td><math>0.07 &lt; W</math></td> <td colspan="2">Treat with dot non-conformance</td> </tr> </table> |                      |                                | Size(mm)          |        | Most approve q'ty |   |   | L(length) | W(width)         | A      | B | C      | ignore                  | $W \leq 0.03$ | ignore |                         | ignore | $L \leq 5.0$ | $0.03 < W \leq 0.05$    | 2 |  | $L \leq 3.0$  | $0.05 < W \leq 0.07$ | 1 |  |  | $0.07 < W$ | Treat with dot non-conformance |  |
|                                                         |                                | Size(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      | Most approve q'ty              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | L(length)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | W(width)             | A                              | B                 | C      |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | ignore                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | $W \leq 0.03$        | ignore                         |                   | ignore |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $L \leq 5.0$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $0.03 < W \leq 0.05$ | 2                              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | $L \leq 3.0$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $0.05 < W \leq 0.07$ | 1                              |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | $0.07 < W$           | Treat with dot non-conformance |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
| Most approve 3 damages, line to line $\geq 10\text{mm}$ |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                                |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
| 4.2.3                                                   | Polarizer position             | 1) polarizer attach meet drawing,disallow out of LCD.<br>2) polarizer must cover display area (special require unless)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |                                |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |
|                                                         |                                | Minor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                                |                   |        |                   |   |   |           |                  |        |   |        |                         |               |        |                         |        |              |                         |   |  |               |                      |   |  |  |            |                                |  |

| 4.2.4                                                                                                                                                                                                                                                                                             | LCD non-conformance  | <p>(i) crash at side (remark: S=ITO length)</p>  <table border="1" data-bbox="558 423 1192 521"><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0</td><td>≤S</td><td>ignore</td></tr></table> <p>Crash disallow extend to ITO or seal.</p> | X     | Y      | Z           | ≤3.0   | ≤S | ignore | Minor |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------|--------|----|--------|-------|--|
|                                                                                                                                                                                                                                                                                                   |                      | X                                                                                                                                                                                                                                                                                                                              | Y     | Z      |             |        |    |        |       |  |
|                                                                                                                                                                                                                                                                                                   |                      | ≤3.0                                                                                                                                                                                                                                                                                                                           | ≤S    | ignore |             |        |    |        |       |  |
| <p>(ii) commonly surface scathe</p>  <table border="1" data-bbox="534 857 1212 954"><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤2.0</td><td>&lt;frame edge</td><td>ignore</td></tr></table>                 | X                    | Y                                                                                                                                                                                                                                                                                                                              | Z     | ≤2.0   | <frame edge | ignore |    |        |       |  |
| X                                                                                                                                                                                                                                                                                                 | Y                    | Z                                                                                                                                                                                                                                                                                                                              |       |        |             |        |    |        |       |  |
| ≤2.0                                                                                                                                                                                                                                                                                              | <frame edge          | ignore                                                                                                                                                                                                                                                                                                                         |       |        |             |        |    |        |       |  |
| <p>(iii) crack</p> <p>Disallow extend crack</p>  <table border="1" data-bbox="667 1229 1096 1319"><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤2.0</td><td>&lt;frame edge</td><td>ignore</td></tr></table> | X                    | Y                                                                                                                                                                                                                                                                                                                              | Z     | ≤2.0   | <frame edge | ignore |    |        |       |  |
| X                                                                                                                                                                                                                                                                                                 | Y                    | Z                                                                                                                                                                                                                                                                                                                              |       |        |             |        |    |        |       |  |
| ≤2.0                                                                                                                                                                                                                                                                                              | <frame edge          | ignore                                                                                                                                                                                                                                                                                                                         |       |        |             |        |    |        |       |  |
| 4.2.                                                                                                                                                                                                                                                                                              | Contrast voltage arp | VOP/Vlcd voltage of confirmed sample±0.15V                                                                                                                                                                                                                                                                                     | Minor |        |             |        |    |        |       |  |
| 4.2.6                                                                                                                                                                                                                                                                                             | color                | Color & luminance of module scope reference spec                                                                                                                                                                                                                                                                               | Minor |        |             |        |    |        |       |  |
| 4.2.7                                                                                                                                                                                                                                                                                             | Cross talk           | Reference confirmed limit sample                                                                                                                                                                                                                                                                                               | Minor |        |             |        |    |        |       |  |

## 12. Handling Precautions

### 12.1 Mounting method

The LCD panel of LTK LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

### 12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl), Sulfur (S)

If goods were sent without being silicide coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

### 12.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### 12.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity

### 12.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required.

## 12.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.  
[It is recommended to store them as they have been contained in the inner container at the time of delivery from us

## 12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

## 13. Precaution For Use

### 13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

### 13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to LTK LCD , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

## 14. Packing Method

TBD

## **Disclaimer**

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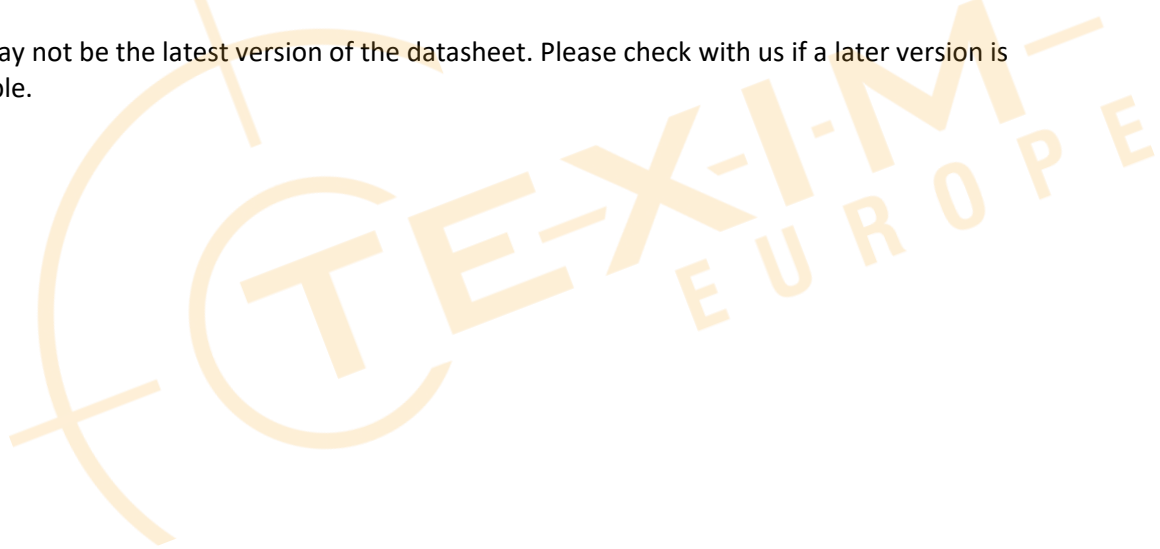
It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application.

Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time.

All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts.

Please contact us if you have any questions about the contents of the datasheet.

This may not be the latest version of the datasheet. Please check with us if a later version is available.





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