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**LIQUID CRYSTAL DISPLAY MODULE**  
**MODEL: MTF-TQ57SN721-AV**  
**Customer's No.:**

|            |
|------------|
| Acceptance |
|            |

*Microtips Technology Inc.*  
 12F. No.31 Lane 169, Kang Ning St.,  
 His-Chih, Taipei Hsien, Taiwan  
 FAX: 886-2-26958625

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|-------------------------|
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## 1. GENERAL DESCRIPTION AND FEATURES

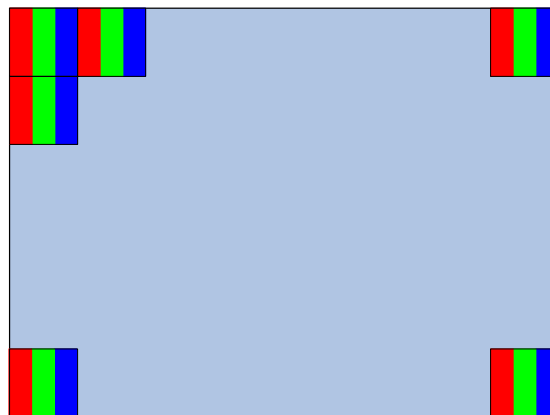
MTF-TQ57SN721-AV is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 5.7" contains 320RGBx240 dots and can display up to 262K colors. The following table described the features of MTF-TQ57SN721-AV.

### 1.1 Features

- Transmissive type with LED back-light.
- TN (Twisted Nematic) mode.
- Digital RGB (6bits/color) Data Transfer
- Backlight-driving DC/AC inverter is not built in this module.

### 1.2 General Specifications

| Item               | Specification   | Unit |
|--------------------|---|------|
| Screen Size        | 5.7 inches diagonal                                     | -    |
| Display Resolution | 320 x RGB x 240   | Dot  |
| Pixel Pitch        | 0.36 (H) ×0.36 (V)                                      | mm   |
| Active Area        | 115.2 (W) x 86.4 (H)                                    | mm   |
| Outline Dimension  | 144.0 (W) x 104.6 (H) x 12.8 (T),<br>without FPCB tail. | mm   |
| Weight             | 155g (MTF-TQ57SN721-AV)                                 | -    |
|                    | 202g (MTF-TQ57SP721-AV)                                 |      |
| Display Mode       | Normally white/Transmissive/Wide view                   | -    |
| Pixel Arrangement  | RGB-Vertical Stripe                                     | -    |
| Surface Treatment  | Non-glare (3H)  | -    |
| Viewing Direction  | 6 o'clock   | -    |
| Input Interface    | Digital RGB (6bits/color) Data Transfer                 | -    |
| TFT Driver         | Source: Himax HX8218A, Gate: Himax HX8615A              | -    |
| Color Garmut       | NTSC 58%  | -    |



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## 2. INPUT TERMINAL PIN ASSIGNMENT

### 2.1 Pin Assignment

| Pin No. | Symbol          | I/O | Function  | Remark  |
|---------|-----------------|-----|---|---------|
| 1       | DGND            | -   | GND   | -       |
| 2       | DCLK            | I   | Clock signal for sampling each data signal                                      | -       |
| 3       | Hsync           | I   | Horizontal synchronous signal (Negative)  | -       |
| 4       | Vsync           | I   | Vertical synchronous signal (Negative)  | -       |
| 5       | GND             | I   | GND   | -       |
| 6       | R0              | I   | RED data signal (LSB)   | -       |
| 7       | R1              | I   | RED data signal   | -       |
| 8       | R2              | I   | RED data signal   | -       |
| 9       | R3              | I   | RED data signal   | -       |
| 10      | R4              | I   | RED data signal   | -       |
| 11      | R5              | I   | RED data signal (MSB)   | -       |
| 12      | GND             | -   | GND   | -       |
| 13      | G0              | I   | GREEN data signal (LSB)   | -       |
| 14      | G1              | I   | GREEN data signal   | -       |
| 15      | G2              | I   | GREEN data signal   | -       |
| 16      | G3              | I   | GREEN data signal   | -       |
| 17      | G4              | I   | GREEN data signal   | -       |
| 18      | G5              | I   | GREEN data signal (MSB)   | -       |
| 19      | GND             | -   | GND   | -       |
| 20      | B0              | I   | BLUE data signal(LSB)   | -       |
| 21      | B1              | I   | BLUE data signal  | -       |
| 22      | B2              | I   | BLUE data signal  | -       |
| 23      | B3              | I   | BLUE data signal  | -       |
| 24      | B4              | I   | BLUE data signal  | -       |
| 25      | B5              | I   | BLUE data signal(MSB)   | -       |
| 26      | GND             | -   | GND   | -       |
| 27      | DEN             | I   | Signal to settle the horizontal display position (Positive)                     | Note5-1 |
| 28      | V <sub>DD</sub> | -   | + 3.3V power supply   | -       |
| 29      | V <sub>DD</sub> | -   | + 3.3V power supply   | -       |
| 30      | LRC             | I   | Horizontal display mode select signal L: Normal<br>H: Left / Right reverse mode | Note5-2 |

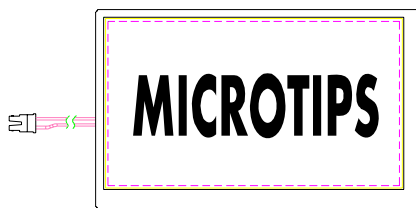


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|    |     |   |  |         |
|----|-----|---|--|---------|
| 31 | UDC | I | Vertical display mode select signal H: Normal<br>L: Up / Down reverse mode | Note5-3 |
| 32 | NC  | - | No Connection  | -       |
| 33 | GND | I | GND  | -       |

Note5-1 The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined. Don't keep ENAB "High" during operation.

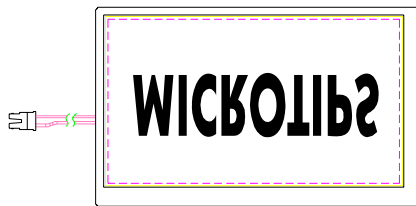
Note5-2,3



R/L = L, U/D = H



R/L = H, U/D = H



R/L = L, U/D = L



R/L = H, U/D = L

## 2.2 Back-light Unit (BLU)

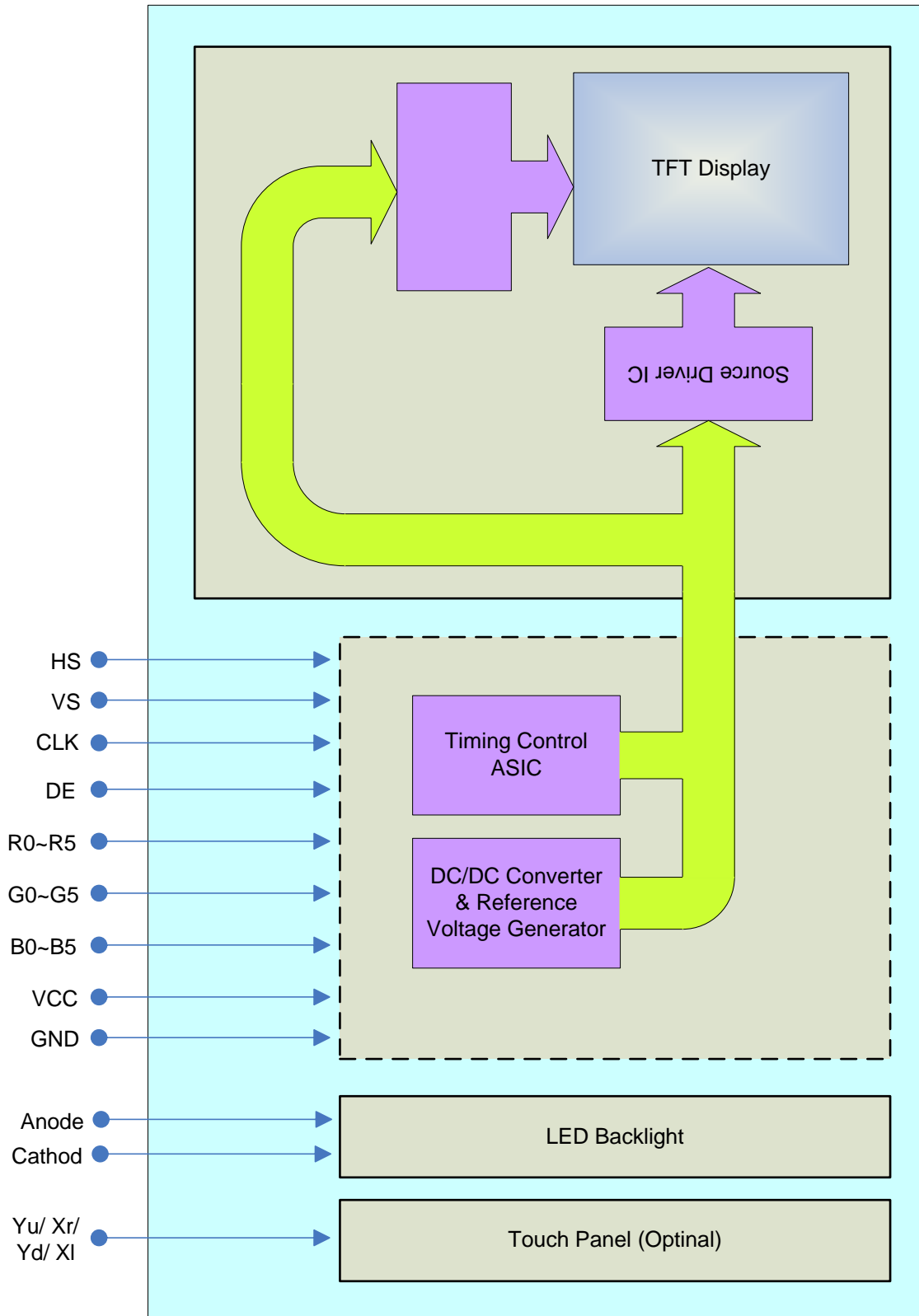
| Pin No. | Symbol | Function                       | Remark |
|---------|--------|--------------------------------|--------|
| 1       | LEDA   | Power Supply for LED backlight |        |
| 2       | LEDK   | GND for LED backlight          |        |



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### 3. BLOCK DIAGRAM



Gate Driver IC



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#### 4. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: LCD-5000, BM-5A, BM-7, PR-650, EZ-Contrast

(Ta=25°C , If=300mA)

| Item               |                  | Symbol         | Condition                                     | Min   | Type  | Max   | Unit              | Note   |
|--------------------|------------------|----------------|---|-------|-------|-------|-------------------|--------|
| Brightness         | MTF-TQ57SN721-AV | Br             | 300mA/6.6V                                    | -     | 500   | -     | cd/m <sup>2</sup> | Note 1 |
|                    | MTF-TQ57SP721-AV |                |   | -     | 400   | -     | cd/m <sup>2</sup> |        |
| Response time      |                  | T <sub>r</sub> | θ=0°  | -     | 15    | 20    | ms                | Note 2 |
|                    |                  | T <sub>f</sub> |   | -     | 35    | 50    | ms                |        |
| Contrast ratio     |                  | CR             | At optimized viewing angle                    | 150   | 250   | -     | -                 | Note 3 |
| Color Chromaticity | Red              | R <sub>x</sub> | θ=0° Normal Viewing Angle                     | 0.610 | 0.640 | 0.670 | -                 | -      |
|                    |                  | R <sub>y</sub> |   | 0.314 | 0.344 | 0.374 |                   |        |
|                    | Green            | G <sub>x</sub> |   | 0.268 | 0.298 | 0.328 | -                 |        |
|                    |                  | G <sub>y</sub> |   | 0.553 | 0.583 | 0.613 |                   |        |
|                    | Blue             | B <sub>x</sub> |   | 0.107 | 0.137 | 0.167 | -                 |        |
|                    |                  | B <sub>y</sub> |   | 0.139 | 0.159 | 0.179 |                   |        |
|                    | White            | W <sub>x</sub> |   | 0.282 | 0.312 | 0.342 | -                 |        |
|                    |                  | W <sub>y</sub> |   | 0.319 | 0.349 | 0.379 |                   |        |
| Viewing Angle (6H) | Hor.             | θ <sub>R</sub> | CR≥10   | -     | 65    | -     | Degree            | Note 4 |
|                    |                  | θ <sub>L</sub> |   | -     | 65    | -     |                   |        |
|                    | Ver.             | θ <sub>B</sub> |   | -     | 50    | -     |                   |        |
|                    |                  | θ <sub>F</sub> |   | -     | 65    | -     |                   |        |
| LED Life time      | 25°C             | LL             | I <sub>F</sub> =300mA<br>V <sub>F</sub> =6.6V | -     | 50k   | -     | Hours             | Note 5 |

Note 1 : Test Equipment Setup

After stabilizing and leaving the panel alone at a given temperature for 30 min., the measurement should be executed. Measurement should be executed in a stable, windless, and dark room, 30 min. after turning the back light on. This should be measured in the center of screen.

Back-Light current: 300mA

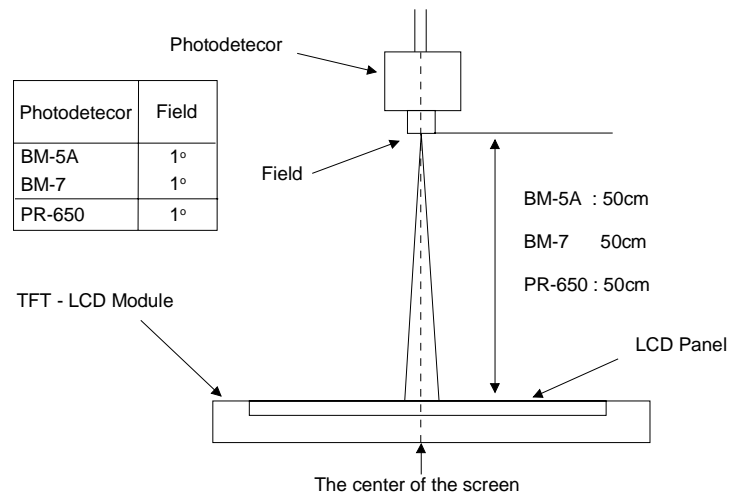
Environment condition: 1. Ta=25±2°C  
2. Illuminations ≤ 1 lux



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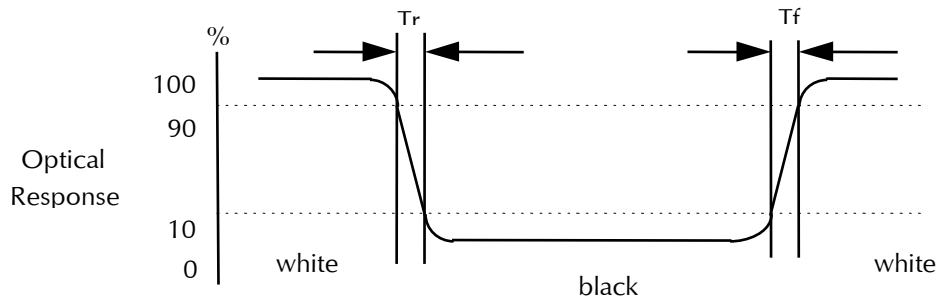


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Note 2 : Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



Note 3 : Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

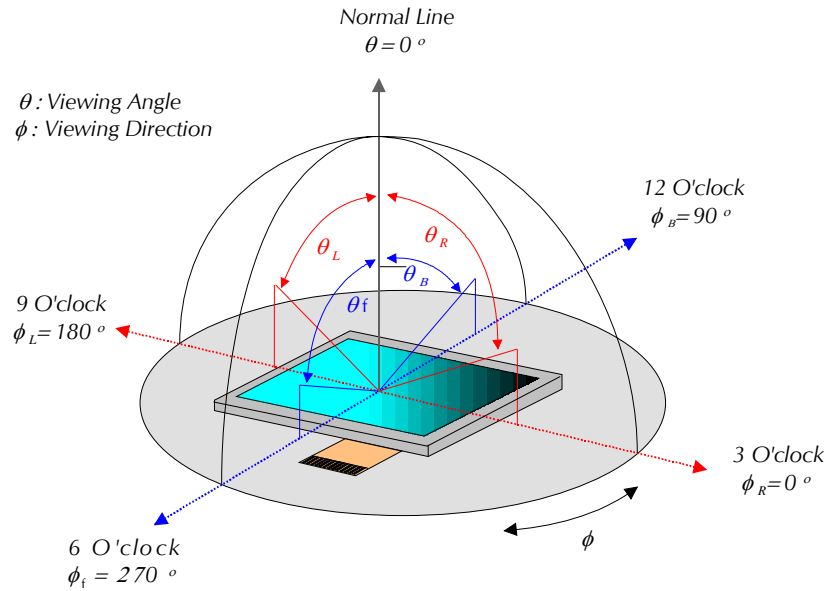
Note 4 : Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



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View Angle



Note 5 : This is the reference value. The white-LED life time is defined as a time when brightness not to become under 50% of the original value (at Ta=25°C)



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## 5. ABSOLUTE MAXIMUM RATINGS

### 5.1 Absolute Ratings of Environment

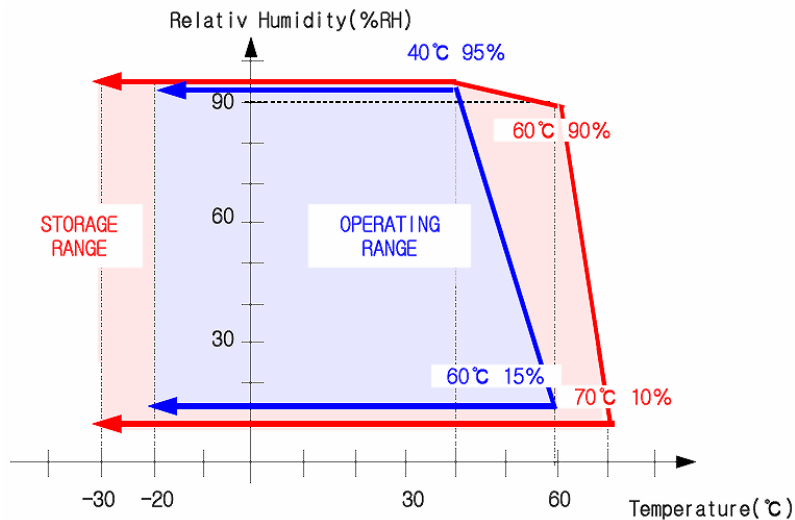
If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

( $T_a=25^{\circ}\text{C}$ ,  $V_{SS}=\text{GND}=0$ )

| Item   | Symbol    | Min. | Max. | Unit               | Note     |
|--|-----------|------|------|--------------------|----------|
| Storage temperature                            | $T_{STG}$ | -30  | 80   | $^{\circ}\text{C}$ | (1)      |
| Operating temperature<br>(Ambient temperature) | $T_{OPR}$ | -20  | 70   | $^{\circ}\text{C}$ | (1), (2) |

Note (1) 95 % RH Max. (  $40^{\circ}\text{C} \geq T_a$  )

Maximum wet-bulb temperature at  $39^{\circ}\text{C}$  or less. ( $T_a > 40^{\circ}\text{C}$ ) No condensation.



- (2) In case of below  $0^{\circ}$ , the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character



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## 5.2 Electrical Absolute Maximum Rating

(Ta=25°C, V<sub>SS</sub>=GND=0)

| Parameter                        | Symbol           | Min.                | Typ. | Max.                | Unit  | Remark                           |
|----------------------------------|------------------|---------------------|------|---------------------|-------|----------------------------------|
| Power Supply Voltage             | V <sub>DD</sub>  | -0.3                | -    | +7.0                | V     | Note 1                           |
| Permissible input ripple voltage | V <sub>RF</sub>  | --                  | --   | 100                 | mVp-p | V <sub>DD</sub> = +3.3V          |
| Input voltage (Low)              | V <sub>IL</sub>  | 0                   | --   | 0.3 V <sub>DD</sub> | V     | Note 2                           |
| Input voltage (High)             | V <sub>IH</sub>  | 0.7 V <sub>DD</sub> | --   | +5.5                | V     |                                  |
| Input current (Low)              | I <sub>OL1</sub> | --                  | --   | 10                  | μA    | V <sub>I</sub> =0V, Note 2       |
| Input current (High)             | I <sub>OH1</sub> | --                  | --   | 10                  | μA    | V <sub>I</sub> =3.3~5.0V, Note 3 |
|                                  | I <sub>OH2</sub> | --                  | --   | 100                 | μA    | V <sub>I</sub> =3.3~5.0V, Note 4 |

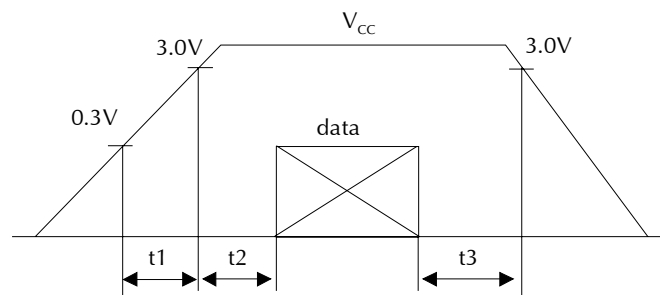
Note1:

V<sub>DD</sub>-turn-on conditions

$$0 < t_1 \leq 20\text{ms}$$

$$0 < t_2 \leq 50\text{ms}$$

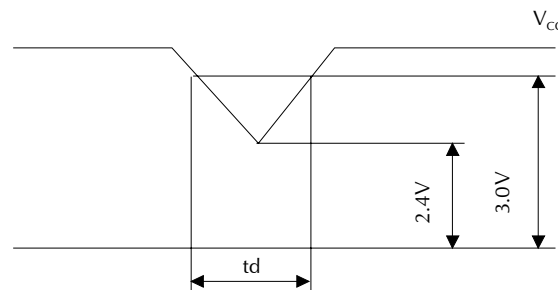
$$0 < t_3 \leq 1\text{s}$$



V<sub>DD</sub>-dip conditions

V<sub>DD</sub>-dip conditions should also follow the V<sub>DD</sub>-turn-on conditions

$$T_d \leq 20\text{ms}$$



Note2: CLK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, DE, R/L, U/D

Note3: CLK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, R/L, U/D

Note4: DE



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## 6. ELECTRICAL CHARACTERISTICS

### 6.1 DC Electrical Characteristics

(Ta=25±2°C, V<sub>SS</sub>=GND=0)

| Item                    | Symbol          | Min.            | Typ.                | Max. | Unit                | Remark |        |
|-------------------------|-----------------|-----------------|---------------------|------|---------------------|--------|--------|
| Supply Voltage          | V <sub>DD</sub> | 3.0             | 3.3                 | 3.6  | V                   |        |        |
| Supply Current          | I <sub>DD</sub> | 40              | 50                  | 60   | mA                  | Note 2 |        |
| Input Voltage for logic | L Level         | V <sub>IH</sub> | 0.7 V <sub>DD</sub> | -    | V <sub>DD</sub>     | V      | Note 1 |
|                         | H Level         | V <sub>IL</sub> | 0                   | -    | 0.3 V <sub>DD</sub> | V      |        |

Note1: Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

Note2: fV =60Hz , Ta=25°C , Display pattern : All Black



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## 6.2 AC Timing Characteristic of The LCD

### 6.2.1 Timing Condition

| Signal   | Parameter            | Symbol    | Min.      | Typ.  | Max.      | Unit.     | Remark |  |
|--|----------------------|-----------|-----------|-------|-----------|-----------|--------|--|
| DCLK   | DCLK period          | $T_{OSC}$ | --        | 156   | --        | ns        |        |  |
|  | Frequency            | $F_{OSC}$ | --        | 6.4   | --        | MHz       |        |  |
|  | DCLK High plus width | $T_{CH}$  | --        | 78    | --        | ns        |        |  |
|  | DCLK Low plus width  | $T_{CL}$  | --        | 78    | --        | ns        |        |  |
| RGB DATA   | Data setup time      | $T_{SU}$  | 12        | --    | --        | ns        |        |  |
|  | Data hold time       | $T_{HD}$  | 12        | --    | --        | ns        |        |  |
| Hsync  | Hsync period         | $T_H$     | --        | 408   | --        | $T_{OSC}$ |        |  |
|  | Hsync pulse width    | $T_{HS}$  | 5         | 30    | --        | $T_{OSC}$ |        |  |
|  | Back-Porch           | $T_{HB}$  | --        | 38    | --        | $T_{OSC}$ |        |  |
|  | Front-Porch          | $T_{HF}$  | --        | 20    | --        | $T_{OSC}$ |        |  |
|  | Hsync rising time    | $T_{Cr}$  | --        | --    | 700       | ns        |        |  |
|  | Hsync falling time   | $T_{Cf}$  | --        | --    | 300       | ns        |        |  |
| Vsync  | Vsync period         | NTSC      | --        | 262.5 | --        | $T_H$     |        |  |
|  |                      | PAL       | --        | 312.5 | --        | $T_H$     |        |  |
|  | Vsync pulse width    | $T_{VS}$  | 1         | 3     | 5         | $T_H$     |        |  |
|  | Back-Porch           | NTSC      | $T_{VB}$  | --    | 15        | --        | $T_H$  |  |
|  |                      | PAL       | $T_{VB}$  | --    | 23        | --        | $T_H$  |  |
|  | Display Period       | $T_{VD}$  | --        | 240   | --        | $T_H$     |        |  |
|  | Front Porch          | NTSC      | $T_{VF}$  | --    | 4.5       | --        | $T_H$  |  |
|  |                      | PAL       | $T_{VF}$  | --    | 46.5      | --        | $T_H$  |  |
|  | Vsync rising time    | $T_{Vr}$  | --        | --    | 700       | ns        |        |  |
|  | Vsync falling time   | $T_{Vf}$  | --        | --    | 1.5       | $\mu s$   |        |  |
| Vsync falling to Hsync rising time for odd field   | $T_{HVO}$            | 1         | --        | --    | $T_{OSC}$ |           |        |  |
| Vsync falling to Hsync falling time for even field | $T_{HVE}$            | 1         | --        | --    | $T_{OSC}$ |           |        |  |
| DEN  | Vsync-DEN time       | NTSC      | $T_{VSE}$ | --    | 18        | --        | $T_H$  |  |
|  |                      | PAL       | $T_{VSE}$ | --    | 26        | --        | $T_H$  |  |
|  | Hsync-DEN time       | $T_{HE}$  | 36        | 68    | 88        | $T_{OSC}$ |        |  |
|  | DEN plus width       | $T_{EP}$  | --        | 320   | --        | $T_{OSC}$ |        |  |

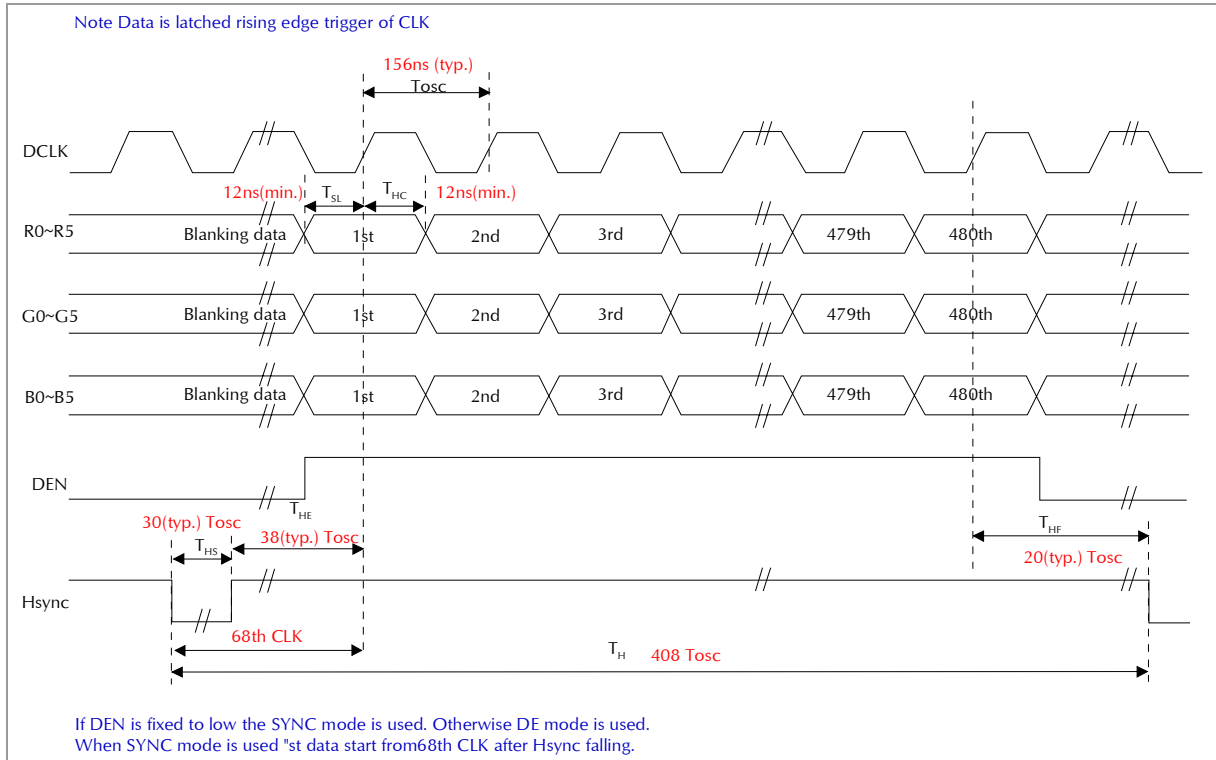
Note : If DEN is fixed to low, the SYNC mode is used. Otherwise DE mode is used. When SYNC mode is used, 1st data start from 68th CLK after Hsync falling



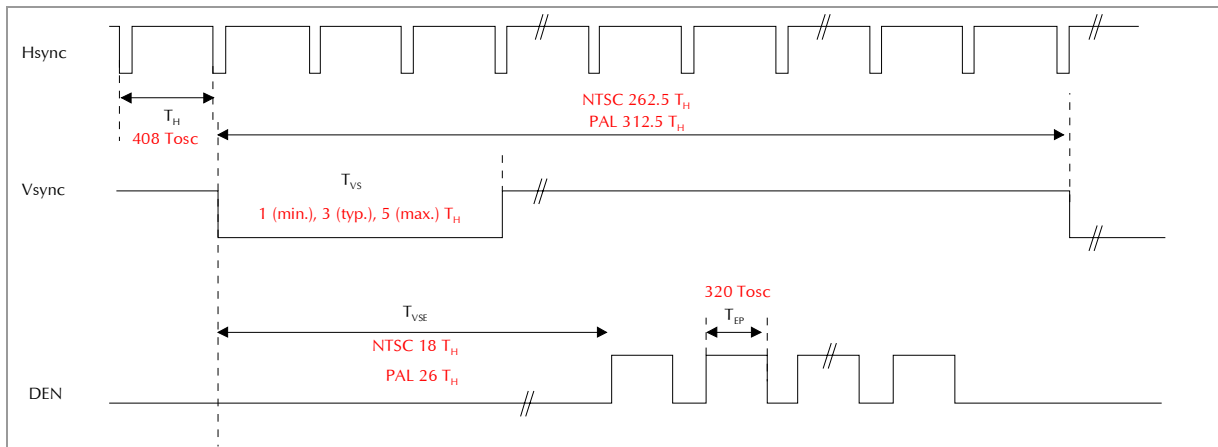
Messrs.

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### 6.2.2 Horizontal Display Timing



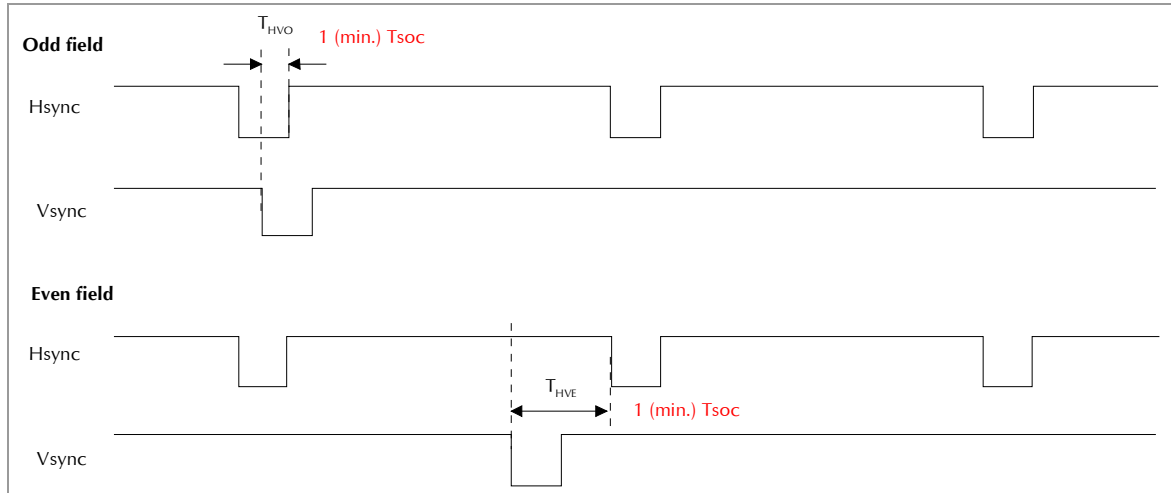
### 6.2.3 Vertical Display Timing



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#### 6.2.4 Hsync and Vsync Timing





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## 7. BACKLIGHT SPECIFICATIONS

### 7.1 Absolute Maximum Ratings

Ta=25°C

| Item                  | Symbol          | Maximum rating | Unit | Note |
|-----------------------|-----------------|----------------|------|------|
| Peak Forward Current  | I <sub>FM</sub> | 450            | mA   | (1)  |
| Reverse Voltage       | V <sub>R</sub>  | 10             | V    | -    |
| Power Dissipation     | P <sub>D</sub>  | 3300           | mW   | -    |
| Operating Temperature | T <sub>OP</sub> | -20~70         | °C   | -    |
| Storage Temperature   | T <sub>ST</sub> | -30~80         | °C   | -    |

Note (1): Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

Functional operation should be restricted to the conditions described under normal operating conditions.

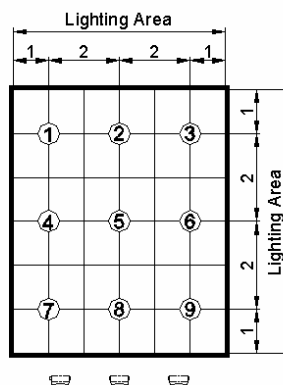
### 7.2 Electrical/Operating Characteristics

Ta = 25°C

| Parameter                | Symbol         | Min. | Typ. | Max. | Units | Test Condition      |
|--------------------------|----------------|------|------|------|-------|---------------------|
| Forward Voltage          | V <sub>F</sub> | -    | 6.6  | -    | V     | Ta=25°C<br>IF=300mA |
| LED Current              | I <sub>F</sub> | -    | 300  | -    | mA    |                     |
| Uniformity*              | -              | 80   | -    | -    | %     |                     |
| Chromaticity Coordinates | X              | 0.26 | 0.29 | 0.32 | -     |                     |
|                          | Y              | 0.26 | 0.29 | 0.32 | -     |                     |

\*: Uniformity = (Min./Max.) x 100%

Unregistered HyperSnap



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## 8. DISPLAYED COLOR AND INPUT DATA

|             | Color & Gray Scale | Data Signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------|--------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|             |                    | R5          | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Red(0)             | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Green(0)           | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Blue(0)            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Cyan               | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Magenta            | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|             | Yellow             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | White              | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Red         | Black              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Red(62)            | 1           | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Red(61)            | 1           | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Red(31)            | 1           | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Red(1)             | 0           | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Red(0)      | 0                  | 0           | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  |    |
| Green       | Black              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Green(62)          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Green(61)          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Green(31)          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Green(1)           | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Green(0)    | 1                  | 1           | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |    |
| Blue        | Black              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|             | Blue(62)           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|             | Blue(61)           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Blue(31)           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  |
|             | :                  | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |
|             | Blue(1)            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 1  |
| Blue(0)     | 1                  | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |    |

0 : Low level voltage, 1 :High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. With the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.



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## 9. QUALITY STANDARD FOR LCD

### 9.1 Objective

This specification book is the standard for LCD module general inspection. And also this book will be refer to customer approval specification.

### 9.2 Scope

This specification book is applicable to general LCD module. If supplier has any doubt or requirement, then it can be discussed.

#### 9.2.1 Acceptable Quality Level

| INSPECTION | SAMPLING PROCEDURES   | A.Q.L |
|------------|---|-------|
| Major      | MIL-STD-105E Inspection Level II<br>Normal Inspection<br>Single sample inspection | 1     |
| Minor      | MIL-STD-105E Inspection Level II<br>Normal Inspection<br>Single sample inspection | 1.5   |

#### Major defect :

A major defect is a defect that could result in failure or extremely reduction on the usability of the product for its intended purpose.

#### Minor defect :

A minor defect is one that does not materially reduce the usability of the product for its intended purpose or is a departure from established standards giving no significant bearing on the effective use or operation of the unit.

### 9.2.2 Inspection Conditions

#### 9.2.2.1 The environmental conditions for inspection shall be as follows

- Room Temperature :  $25 \pm 10^{\circ}\text{C}$
- Humidity Temperature :  $45 \pm 20\% \text{RH}$

### 9.2.3 The external visual inspection

- The inspection shall be performed by using 40Watts fluorescent lamp for illumination and the distance between LCD and eyes of the inspector shall be 30cm or more.

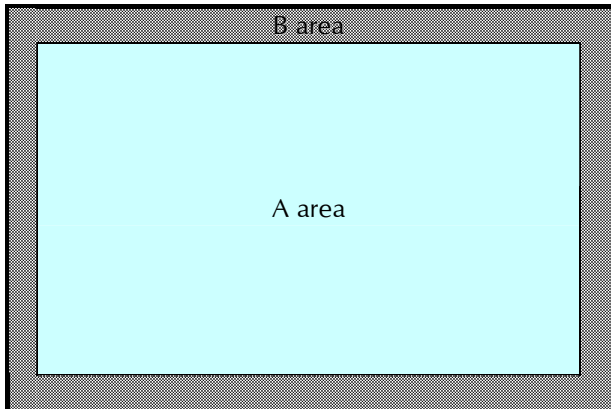


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#### 9.2.4 Inspection Item

|  |   |
|--|---|
| Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble | The color of a small area is different from the remainder. The phenomenon dose not change with voltage. |
| Contrast variation   | The color of a small area is different from the remainder. The phenomenon change with voltage.          |
| Glass defect   | Glass crack, Chip   |
| Operating  | Function, Contrast, Uniformity, Components  |

#### 9.2.5 Definition of the Area



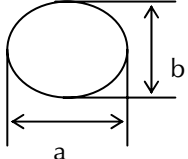
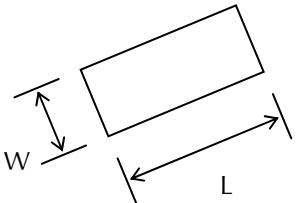
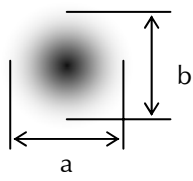
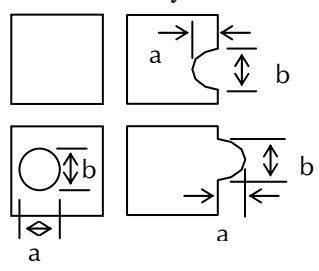
A area: Viewing Area  
 B area: Out of Viewing Area



|                       |        |                  |          |              |         |
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### 9.3 Inspection specification

#### 9.3.1 Non-operating inspection specification

| Class of defects         | No.   | Inspection Item   | Criteria of defects   |                       | Acceptable Q'ty |        |        |
|--------------------------|---|---|---|-----------------------|-----------------|--------|--------|
|                          |   |   |   |                       | Zone A          | Zone B |        |
| Major                    | 1   | Circuits  | 1. Circuit short  |                       | 0               | 0      |        |
|                          |   |   | 2. Circuit open   |                       |                 |        |        |
| Minor                    | 2   | Black spot, White spot,<br>Bright spot, Foreign particle<br><br>$\phi = (a+b)/2$ | A   | $\phi \leq 0.3$       | Ignore          | Ignore |        |
|                          |   |   | B   | $0.3 < \phi \leq 0.4$ | 4               |        |        |
|                          |   |   | C   | $0.4 < \phi \leq 0.5$ | 2               |        |        |
|                          |   |   | D   | $0.5 < \phi$          | 0               |        |        |
|                          |   |   | Total defect point (B,C)                                      |                       | 4               |        |        |
|                          |   |   | * Reject when 5 or more spots are gathered within 5mm circle. |                       |                 |        |        |
|                          | 3   | Black line, White line<br>  | A   | $W \leq 0.02$         | -               | *      | Ignore |
|                          |   |   | B   | $0.02 < W \leq 0.05$  | $L \leq 5$      | 2      |        |
|                          |   |   | C   | $0.05 < W \leq 0.1$   | $L \leq 3$      | 2      |        |
|                          |   |   | D   | $0.1 < W$             | -               | 0      |        |
|                          |   |   | Total defect point (B,C)                                      |                       | 3               |        |        |
|                          |   |   | * Reject when 5 or more spots are gathered within 5mm circle. |                       |                 |        |        |
|                          | 4   | Contrast variation<br><br>$\phi = (a+b)/2$                                     | A   | $\phi \leq 0.3$       | Ignore          | Ignore |        |
|                          |   |   | B   | $0.3 < \phi \leq 0.4$ | 4               |        |        |
|                          |   |   | C   | $0.4 < \phi \leq 0.5$ | 2               |        |        |
| D                        |   |   | $0.5 < \phi$  | 0                     |                 |        |        |
| Total defect point (B,C) |   |   | 4   |                       |                 |        |        |
|                          |   |   |   |                       |                 |        |        |
| 5                        | attern deformity<br><br>$\phi = (a+b)/2$ | 1. Pin hole   |   | Ignore                | Ignore          |        |        |
|                          |   | A   | $\phi \leq 0.15$  |                       |                 |        |        |
|                          |   | B   | $0.15 < \phi \leq 0.2$  |                       |                 | 2 (*)  |        |
|                          |   |   |   | $0.2 < \phi$          | 0               |        |        |
|                          |   | * Two pin hole shall not formed in the single dot   |   |                       |                 |        |        |
|                          |   | 2. Excess, void   |   |                       |                 |        |        |
|                          |   | A   | $a \leq 0.2$ & $b \leq 0.2$                                   | Ignore                | Ignore          |        |        |
|                          |   | B   | $0.2 < a$ or $0.2 < b$  | 0                     |                 |        |        |
| Minor                    | 6   | Dot defect  | A   | Bright dot            | $N \leq 2$      | Ignore |        |
|                          |   |   | B   | Dark dot              | $N \leq 3$      |        |        |



|                       |        |                  |          |              |         |
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|       |                                    |   |  |                          |            |  |
|-------|------------------------------------|---|--|--------------------------|------------|--|
|       |                                    |   | C  | Total Bright & Dark Dots | $N \leq 4$ |  |
|       |                                    |   | * This inspection item does not apply to B/W LCD |                          |            |  |
| 7     | Bubble between Polarizer and panel | A   | $\phi \leq 0.3$                                  | Ignore                   | Ignore     |  |
|       |                                    | B   | $0.3 < \phi \leq 0.5$                            | 2                        |            |  |
|       |                                    | C   | $0.5 < \phi$                                     | 0                        |            |  |
| 8     | Polarizer scratch and particle     | Circular : Same as inspection item No.2   |  |                          | Ignore     |  |
|       |                                    | Linear : Same as inspection item No.3   |  |                          |            |  |
| 9     | Polarizer Dent                     | A   | $\phi \leq 0.2$                                  | Ignore                   | Ignore     |  |
|       |                                    | B   | $0.2 < \phi \leq 0.3$                            | 4                        |            |  |
|       |                                    | C   | $0.3 < \phi \leq 0.4$                            | 2                        |            |  |
|       |                                    | D   | $0.4 < \phi$                                     | 0                        |            |  |
|       |                                    | Total defect point (B,C)  |  | 3                        |            |  |
| 10    | Bubble in the Cell                 | Any size  |  | 0                        | 0          |  |
| 11    | Dirt on polarizer                  | Dirt which can be wiped easily should be accepted.  |  |                          |            |  |
| 12    | Protection film                    | The protection film should not be stripped up to viewing area and the peeled off angle should not exceed 20 degrees.  |  |                          |            |  |
| 13    | Polarizer shift                    | <ol style="list-style-type: none"> <li>Shifting in position should not exceed the glass outline dimension.</li> <li>Incomplete covering of the viewing area due to shifting is not allowed.</li> <li>Shifting in position should be within the tolerance (refer to module dimensional drawing)</li> </ol> |  |                          |            |  |
| 14    | Silicon                            | <ol style="list-style-type: none"> <li>Silicon must cover all circuits.</li> <li>Silicon thickness should be within specification (refer to module dimensional drawing)</li> </ol>  |  |                          |            |  |
| 15    | Tape                               | <ol style="list-style-type: none"> <li>Location: refer to specification.</li> <li>Insufficient adhesive.</li> </ol>   |  |                          |            |  |
| Major | 16                                 | TCP, FPC defect   | Film or Pattern should not have crack.           |                          |            |  |
|       | 17                                 | Components  | Missing components not allowed.                  |                          |            |  |



|                       |        |                  |          |              |         |
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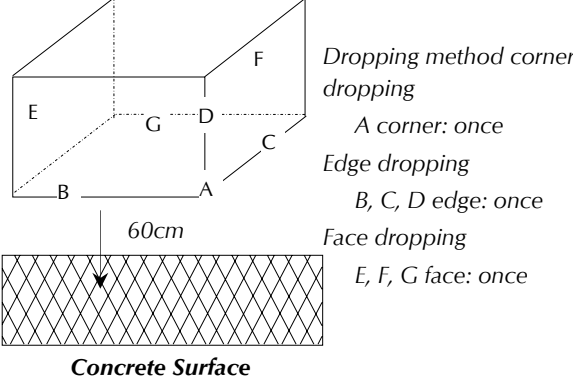
| Class of defects | No. | Inspection Item                       | Criteria of defects  |
|------------------|-----|---------------------------------------|--|
| Major            | 1   | No display                            | -  |
|                  | 2   | Abnormal operation                    | -  |
|                  | 3   | Contrast defect                       | Judge according to module specification.<br>Establish boundary sample if required. |
|                  | 4   | Viewing angle defect                  | Judge according to module specification.<br>Establish boundary sample if required. |
|                  | 5   | Excess power consumption              | Judge according to module specification.   |
|                  | 6   | Back-light, LED defect                | 1. No lit-on<br>2. Different color<br>3. Low brightness                            |
|                  | 7   | Speaker, Vibrator defect              | 1. No operation<br>2. Abnormal operation   |
| Minor            | 8   | Cross-talk defect                     | No noticeable crosstalk.<br>Establish boundary sample if required.                 |
|                  | 9   | Uneven brightness                     | No noticeable unevenness allowed.<br>Establish boundary sample if required.        |
|                  | 10  | Uneven color                          | No noticeable unevenness allowed.<br>Establish boundary sample if required.        |
|                  | 11  | Spot, Pinhole, Foreign particle, Line | Same as in Chapter 7.1   |



|                       |        |                  |          |              |         |
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## 10. RELIABILITY CONDITION FOR LCD

### 10.1 LCM Reliability Test

| No. | Parameter                  | Condition   |
|-----|----------------------------|---|
| 1   | High Temperature Operating | 70°C±2°C, 240 hrs (Operation state)   |
| 2   | Low Temperature Operating  | -20°C±2°C, 240 hrs (Operation state)  |
| 3   | High Temperature Storage   | 80°C±2°C, 240 hrs   |
| 4   | Low Temperature Storage    | -30°C±2°C, 240 hrs  |
| 5   | Damp Proof Test            | 40°C±2°C, 90~95%, 96hrs   |
| 6   | Vibration Test             | Total fixed amplitude: 1.5mm<br>Vibration Frequency: 10~55Hz<br>One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.   |
| 7   | Shock Test                 | To be measured after dropping from 60cm high on the concrete surface in packing state.<br> |

- Notes:
1. No dew condensation to be observed.
  2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
  3. Vibration test will be conducted to the product itself without putting I in a container.





|                       |        |                  |          |              |         |
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## 11. PRECAUTIONS





### 11.1 Operation

Burn-in sometimes happens when the same character was displayed at along time. Therefore, to prevent Burn-in, it is recommended to set up a Screen-saver function.

### 11.2 Safety

The liquid crystal in the LCD is poisonous, DO NOT put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.





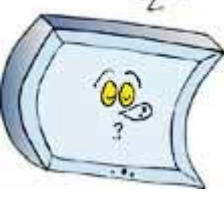

### 11.3 Handling

|   |  |
|---|--|
|    | <p>a. The LCD module shall be installed flat, without twisting or bending.<br/> b. COF or FPC has narrow pattern width, so easily become open circuit by external force. DO NOT apply pressure to COF or FPC especially in bending area.</p> |
|   | <p>c. To avoid damage in appearance or malfunction, DO NOT subject the module to mechanical shock or to excessive force on its surface.</p>  |
|  | <p>d. The polarizer attached to the display is very easy to be damaged, handle it with care to avoid scratching.</p>   |
|  | <p>e. To avoid contamination on the display surface, DO NOT touch the display surface with bare hands.<br/> f. Provide a space so that the LCD module does not come into contact with other components.</p>                                  |



Messrs.

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|   |   |
|---|---|
|    | <p>g. To protect the LCD panel from external pressure, put covering glass (acrylic board or similar board) to keep appropriate space between them.</p>  |
|    | <p>h. Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.</p>  |
|   | <p>i. Property of semiconductor devices may be affected when they are exposed to light possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, your design and mounting layout done are so that the IC is not exposed to light in actual use.</p>                                     |
|  | <p>j. Strong light exposure causes degradation of color filter. It may not recover</p>  |
|  | <p>k. DO NOT contact with water to avoid Metal corrosion.</p> <p>l. When it is not in use, the screen must be turned off or the pattern must be frequently changed by a screen saver. If it displays the same pattern for a long period of time, brightness down/image sticking may develop due to the LCD structure.</p> |
|  | <p>m. Never disassemble LCD product under any circumstances. If unqualified operators or users assemble the product after disassembling it, it may not function or its operation may be seriously affected.</p>   |




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#### 11.4 Static electricity


Since a module is composed of electronic circuits, it is not strong to electrostatic discharge.

|   |  |
|---|--|
|  | <ol style="list-style-type: none"> <li>The LCD module shall be installed flat, without twisting or bending. Ground soldering iron tips, tools and testers when they operate.</li> <li>Ground your body when handling the products.</li> <li>DO NOT apply voltage to the input terminal without applying power supply.</li> <li>DO NOT apply voltage that exceeds the absolute maximum rating.</li> <li>Store the products in an anti-electrostatic container.</li> <li>Peel off protect tape, attached to polarizer, slowly to minimize ESD damage.</li> </ol> |
|---|--|


#### 11.5 Storage

|   |  |
|---|--|
|  | <p>Store the products in a dark place at +5 ~ +25 degree C, low humidity (50%RH or less).<br/>DO NOT store the products in an atmosphere containing organic solvents or corrosive gases.</p> |
|---|--|

#### 11.6 Cleaning

|   |  |
|---|--|
|  | <ol style="list-style-type: none"> <li>DO NOT wipe the polarizer with dry cloth, as it might cause scratch.</li> <li>Wipe the polarizer with a soft cloth soaked with petroleum IPA, other chemical might damage.</li> </ol> |
|---|--|

#### 11.7 Waste

|   |  |
|---|--|
|  | <p>When dispose of LCD module, manage it at the production waste according to the relevant laws and regulations.</p> |
|---|--|



|                       |        |                  |          |              |         |
|-----------------------|--------|------------------|----------|--------------|---------|
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## 12. WARRANTY

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

- 1 We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- 2 We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- 3 We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.
- 4 We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product. Microtips-origin longer than one year from Microtips production.

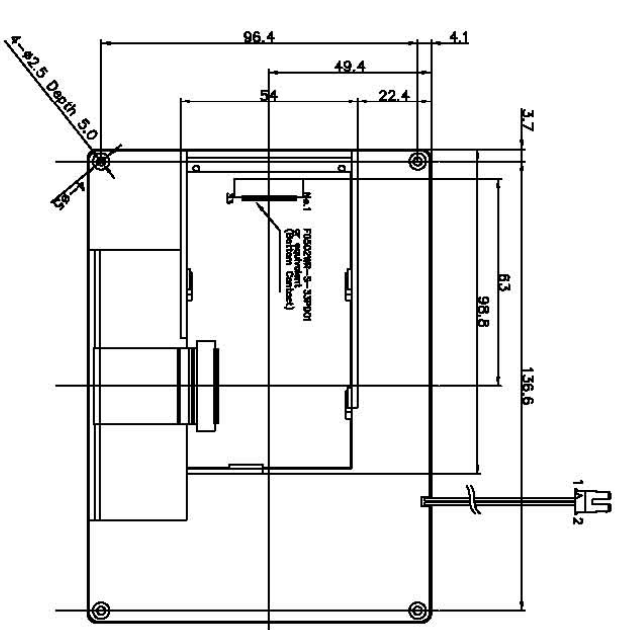
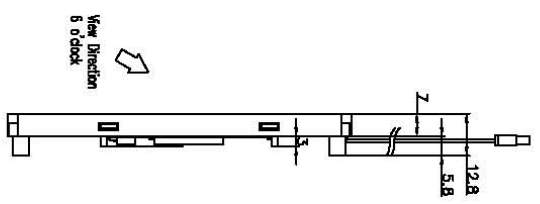
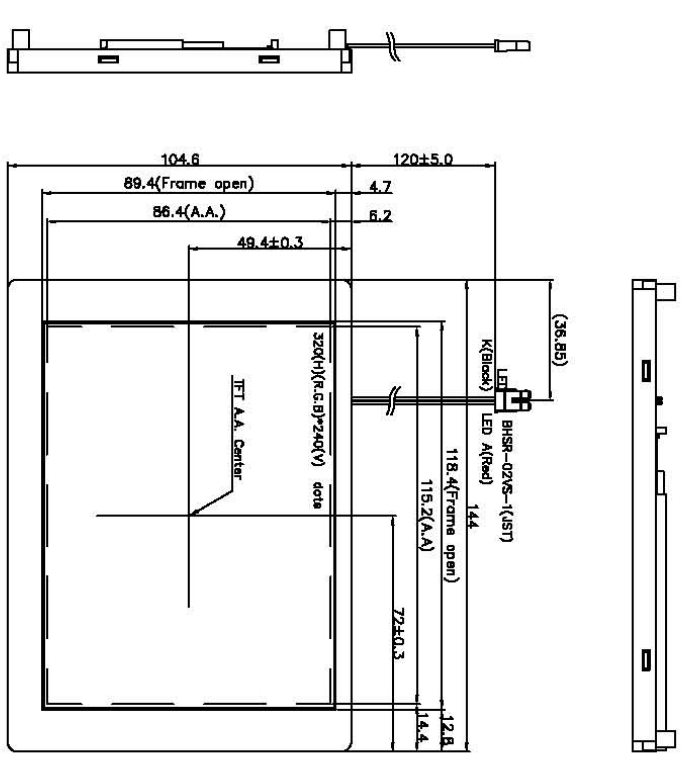
## 13. DIMENSIONAL OUTLINES

See next page.



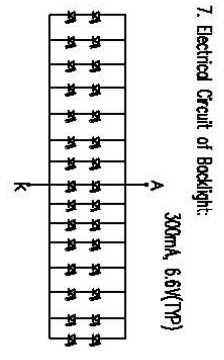
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| REV. | DESCRIPTION | DATE |
|------|-------------|------|
|      |             |      |



- PIN ASSIGNMENT:
- |          |        |        |        |
|----------|--------|--------|--------|
| 1.DGND   | 11.R5  | 21.B1  | 31.DDC |
| 2.DOLK   | 12.GND | 22.B2  | 32.NC  |
| 3.HSYNC1 | 3.GD   | 23.B3  | 33.GND |
| 4.VSYNC1 | 4.G1   | 24.B4  |        |
| 5.GND    | 15.G2  | 25.B5  |        |
| 6.R0     | 16.G3  | 26.GND |        |
| 7.R1     | 17.G4  | 27.DEN |        |
| 8.R2     | 18.G5  | 28.VDD |        |
| 9.R3     | 19.GND | 29.VDD |        |
| 10.R4    | 20.B0  | 30.LRC |        |

- Note:
1. Operating Temperature: -20°C to 70°C
  2. Storage Temperature: -30°C to 80°C
  3. LED Backlight : 30 chip—white LED
  4. No specified  $T_{OL} = \pm 0.3$
  5. Brightness : 500 cd/m<sup>2</sup>(Min)
  6. Uniformity : 75%



|                      |                |                         |  |                         |  |
|----------------------|----------------|-------------------------|--|-------------------------|--|
| NO.                  | M-T057SN721-AV | Q'TY                    | 06/28/07   | MATERIAL                | FINISH                                       |
| PART NAME            |                | APP'D                   | DATE:  | SCALE: 1/1              | FOR MODULE: MT-T057SN721-AV                  |
| DRAWN                | CHECK          | UNIT: MM                | TOLERANCE ON FRACTIONS: DECIMALS ANGLES: 0.10 0.5° | DWG NO.: FT057SN7210-AV | FILE: DWG\Design\COM\MFT\MT-T057SN721-AV.DWG |
| Microtips Technology |                | MTR313 Control 06/28/07 |  | SHEET 1 / 1 Rev: X      |  |