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**LIQUID CRYSTAL DISPLAY MODULE**  
**MODEL: NMTG-F24160BFWHSEB-15**  
**Customer's No.:**

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

*Microtips Technology Inc.*  
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 Taipei Hsien, Taiwan, R.O.C.  
 FAX: 886-2-26958625

| Approved and Checked by |
|-------------------------|
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The Microtips Customized LCD module, model: NMTG-F24160BFWHSEB-15 is compliant with RoHS

## 1. General Specifications

|                       |   |  |
|-----------------------|---|--|
| Operating Temperature | : | Min. -20°C ~ Max. 70°C                 |
| Storage Temperature   | : | Min. -30°C ~ Max. 80°C                 |
| Dot Pixels            | : | 240 (W) x 160 (H) dots                 |
| Dot Size              | : | 0.23 (W) x 0.23 (H) mm                 |
| Dot Pitch             | : | 0.24 (W) x 0.24 (H) mm                 |
| Viewing Area          | : | 61.6 (W) x 42.5 (H) mm                 |
| Outline Dimensions    | : | 74.6* (W) x 54.1 (H) x 4.0 max. (D) mm |
|                       |   | * Not concerning EL pin and FPCB       |
| Weight                | : | N/A                                    |
| LCD Type              | : | FSTN/ Positive mode/ Transflective     |
| Viewing Direction     | : | 6:00                                   |
| Data Transfer         | : | 4-bit parallel data transfer           |
| Backlight             | : | EL backlight (Blue-Green)              |
| Drawings              | : | As attached drawings                   |



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## 2. Electrical Specifications

### 2.1 Absolute Maximum Ratings

$V_{SS} = 0V$

| Parameter                  | Symbol            | Conditions | Min. | Max.           | Units |
|----------------------------|-------------------|------------|------|----------------|-------|
| Supply Voltage (Logic)     | $V_{DD} - V_{SS}$ | -          | -0.3 | 7.0            | V     |
| Supply Voltage (LCD Drive) | $V_0 - V_{SS}$    | -          | -0.3 | 30.0           | V     |
| Input Voltage              | $V_I$             | -          | -0.3 | $V_{DD} + 0.3$ | V     |

### 2.2 DC Characteristics

$T_a = 25^\circ C, V_{SS} = 0V$

| Parameter                        | Symbol            | Conditions        | Min.           | Typ. | Max.        | Units   | Note |
|----------------------------------|-------------------|-------------------|----------------|------|-------------|---------|------|
| Supply Voltage (Logic)           | $V_{DD} - V_{SS}$ | -                 | 2.5            | 3.3  | 5.5         | V       |      |
| Supply Voltage (LCD Drive)       | $V_0 - V_{SS}$    | -                 | 15.0           | -    | 30.0        | V       |      |
|                                  | $V_0 - V_{SS}$    | Shown in 3.1      |                |      |             | V       |      |
| High Level Input Voltage         | $V_{IH}$          | -                 | $0.8V_{DD}$    | -    | -           | V       |      |
| Low Level Input Voltage          | $V_{IL}$          | -                 | -              | -    | $0.2V_{DD}$ | V       |      |
| High Level Output Voltage        | $V_{OH}$          | $I_{OH} = -0.4mA$ | $V_{DD} - 0.4$ | -    | -           | V       |      |
| Low Level Output Voltage         | $V_{OH}$          | $I_{OH} = +0.4mA$ | -              | -    | 0.4         | V       |      |
| Standby Current                  | $I_{STB}$         | -                 | -              | -    | 50          | $\mu A$ | 1    |
| Supply Current (1) Non-selection | $I_{DD1}$         | -                 | -              | -    | 2.0         | mA      | 2    |
| Supply Current (2) Selection     | $I_{DD2}$         | -                 | -              | -    | 8.0         | mA      | 3    |
| Supply Current (3)               | $I_0$             | -                 | -              | -    | 1.0         | mA      | 4    |
| Frame                            | $f_F$             | Duty = 50%        | 65             | 70   | 75          | Hz      |      |

#### NOTES:

- $V_{DD} = +5.0 V, V_0 = +30.0 V, V_I = V_{SS}$ .
- $V_{DD} = +5.0 V, V_0 = +30.0 V, f_{XCK} = 8 MHz, no-load, EI = V_{DD}$ . The input data is turned over by data taking clock (4-bit parallel input mode).
- $V_{DD} = +5.0 V, V_0 = +30.0 V, f_{XCK} = 8 MHz, no-load, EI = V_{SS}$ . The input data is turned over by data taking clock (4-bit parallel input mode).
- $V_{DD} = +5.0 V, V_0 = +30.0 V, f_{XCK} = 8MHz, f_{LP} = 19.2 kHz, f_{FR} = 80 Hz, no-load$ . The input data is turned over by data taking clock (4-bit parallel input mode).



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### 2.3 Signal Timing Diagram

Segment Mode ( $V_{SS}=0V$ ,  $V_{DD}= 4.5\sim 5.5V$ ,  $V_0=15$  to  $30 V$ , and  $T_a=-20$  to  $+85^\circ C$ )

| Parameter                                 | Symbol     | Min. | Max. | Units | Condition            |
|---|------------|------|------|-------|----------------------|
| Shift clock period*                       | $t_{WLP}$  | 71   | --   | ns    | $t_r, t_f \leq 10ns$ |
| Shift clock "H" pulse width               | $t_{WCKH}$ | 23   | --   | ns    |                      |
| Shift clock "L" pulse width               | $t_{WCKL}$ | 23   | --   | ns    |                      |
| Data setup time                           | $t_{DS}$   | 10   | --   | ns    |                      |
| Data hold time                            | $t_{DH}$   | 20   | --   | ns    |                      |
| Latch pulse "H" pulse width               | $t_{WLPH}$ | 23   | --   | ns    |                      |
| Latch pulse rise to shift clock rise time | $t_{LS}$   | 51   | --   | ns    |                      |
| Latch pulse fall to shift clock fall time | $t_{LH}$   | 51   | --   | ns    |                      |
| Input signal rise time**                  | $t_r$      | --   | 50   | ns    |                      |
| Input signal fall time**                  | $t_f$      | --   | 50   | ns    |                      |

Note :

\*Take the cascade connection into consideration.

\*\* $(t_{WLP} - t_{WCKH} - t_{WCKL})/2$  is the maximum in the case of high speed operation.

Segment Mode ( $V_{SS}=0V$ ,  $V_{DD}= 2.5\sim 4.5V$ ,  $V_0=15$  to  $30 V$ , and  $T_a=-20$  to  $+85^\circ C$ )

| Parameter                                 | Symbol     | Min. | Max. | Units | Condition            |
|---|------------|------|------|-------|----------------------|
| Shift clock period*                       | $t_{WLP}$  | 125  | --   | ns    | $t_r, t_f \leq 11ns$ |
| Shift clock "H" pulse width               | $t_{WCKH}$ | 51   | --   | ns    |                      |
| Shift clock "L" pulse width               | $t_{WCKL}$ | 51   | --   | ns    |                      |
| Data setup time                           | $t_{DS}$   | 30   | --   | ns    |                      |
| Data hold time                            | $t_{DH}$   | 40   | --   | ns    |                      |
| Latch pulse "H" pulse width               | $t_{WLPH}$ | 51   | --   | ns    |                      |
| Latch pulse rise to shift clock rise time | $t_{LS}$   | 51   | --   | ns    |                      |
| Latch pulse fall to shift clock fall time | $t_{LH}$   | 51   | --   | ns    |                      |
| Input signal rise time**                  | $t_r$      | --   | 50   | ns    |                      |
| Input signal fall time**                  | $t_f$      | --   | 50   | ns    |                      |

Note :

\*Take the cascade connection into consideration.

\*\* $(t_{WLP} - t_{WCKH} - t_{WCKL})/2$  is the maximum in the case of high speed operation.

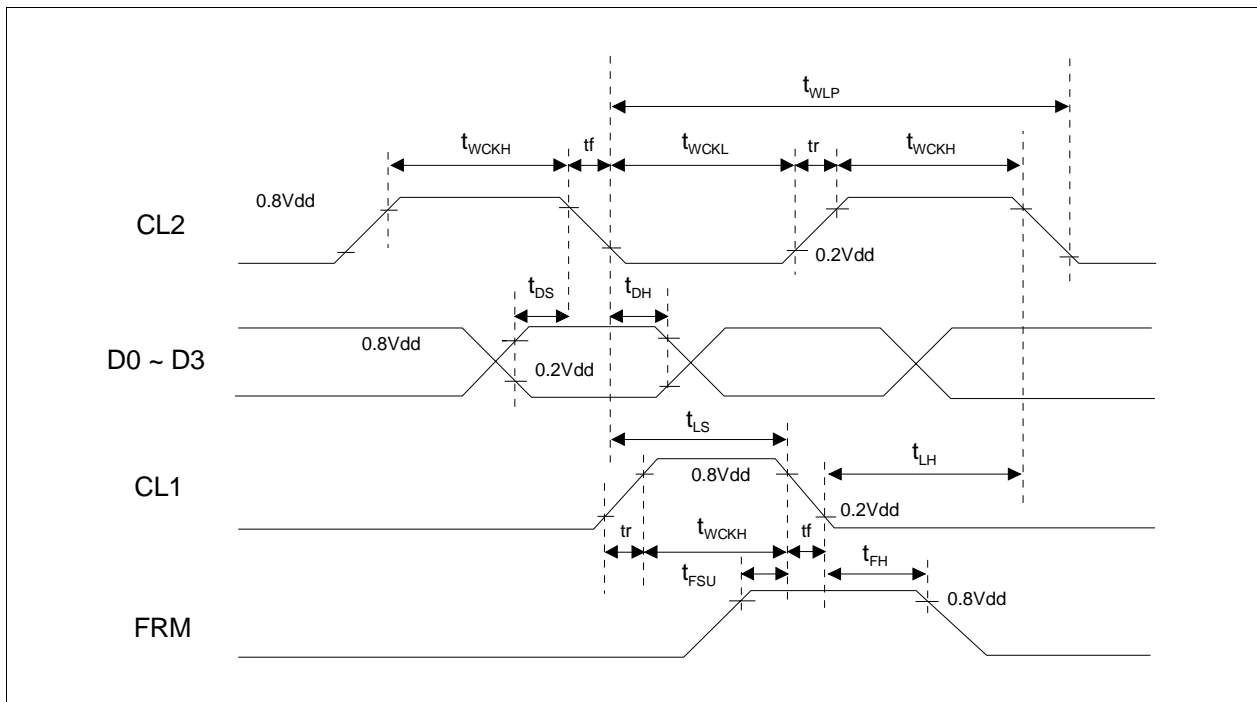


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Common Mode ( $V_{SS}=0V$ ,  $V_{DD}= 2.5\sim 5.5V$ ,  $V_0=15$  to  $30 V$ , and  $T_a=-20$  to  $+85^\circ C$ )

| Parameter                   | Symbol     | Min. | Max. | Units | Condition                |
|-----------------------------|------------|------|------|-------|--------------------------|
| Shift clock period          | $t_{WLP}$  | 250  | -    | ns    | $t_r, t_f \leq 20ns$     |
| Shift clock "H" pulse width | $t_{WCKH}$ | 15   | -    | ns    | $V_{DD} = 5.0V \pm 10\%$ |
|                             |            | 30   | -    | ns    | $V_{DD} = 2.5\sim 4.5V$  |
| Data setup time             | $t_{DS}$   | 30   | -    | ns    |                          |
| Data hold time              | $t_{DH}$   | 50   | -    | ns    |                          |
| Input signal rise time**    | $t_r$      | -    | 50   | ns    |                          |
| Input signal fall time**    | $t_f$      | -    | 50   | ns    |                          |

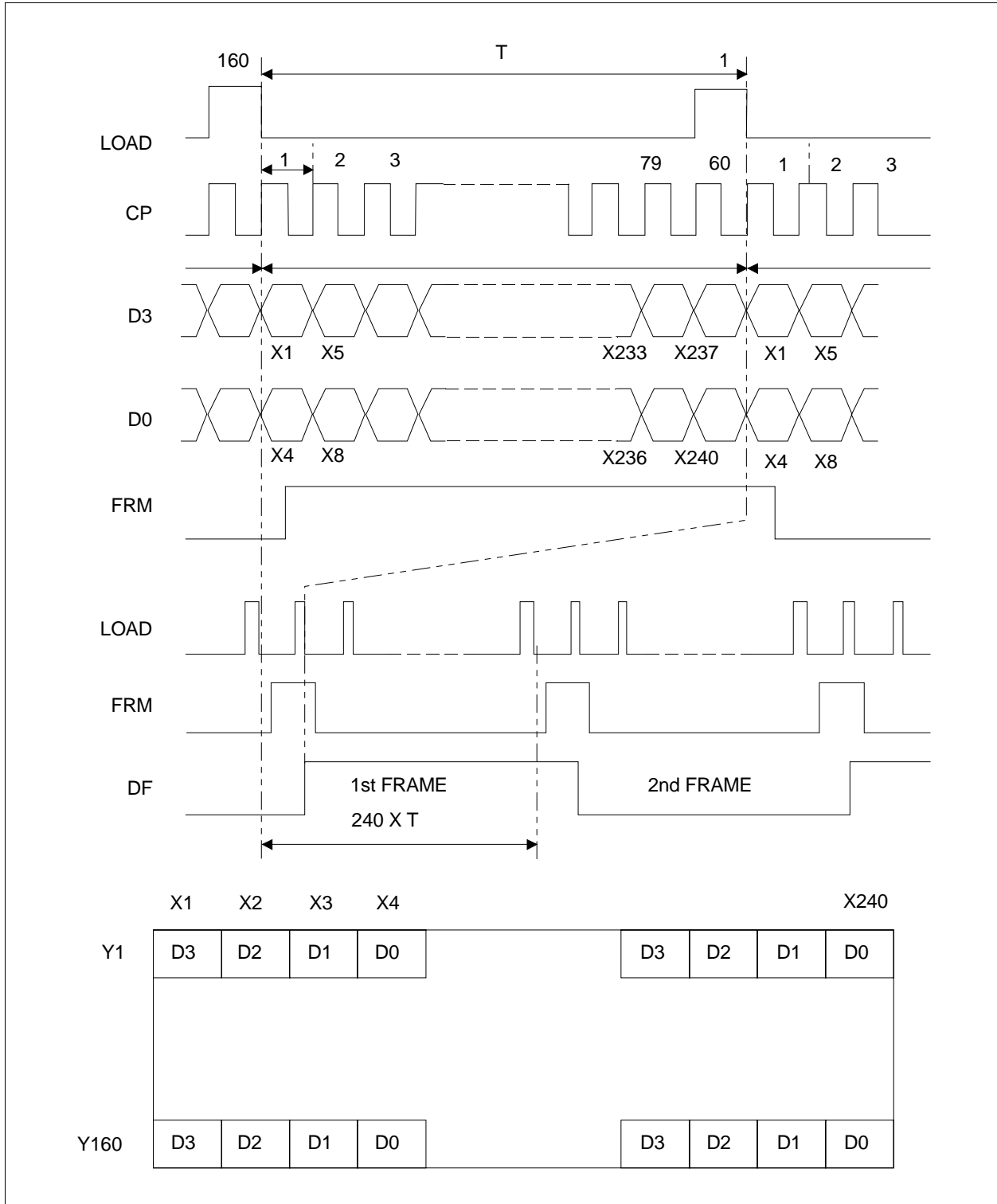


Signal Timing(1)



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2.4 Timing Chart & Comparison of Display and Data



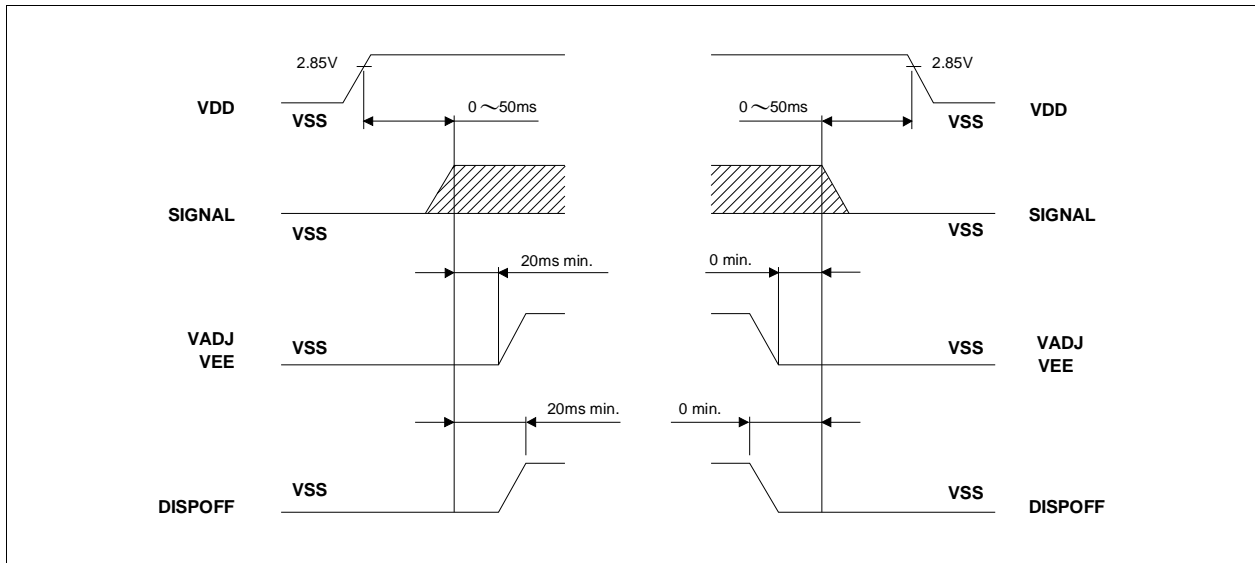
Signal Timing (2)





|                       |                              |          |              |        |
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### 2.5 Power Supply ON/OFF Sequence



The missing pixels may occur when the LCM is driver beyond above power interface timing sequence.



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## 2.6 Lighting Specifications

### 2.6.1 Absolute Maximum Ratings

| Item              | Symbol    | Condition | Min. | Typ. | Max. | Unit      |
|-------------------|-----------|-----------|------|------|------|-----------|
| Operating Voltage | $V_{MAX}$ | Ta= 25°C  | 40   | -    | 120  | $V_{RMS}$ |
| Frequency         | $F_{MAX}$ |           | 50   | -    | 1000 | Hz        |

### 2.6.2 Operating Characteristics

| Item                | Symbol   | Condition   | Min. | Typ. | Max. | Unit               |
|---------------------|----------|---|------|------|------|--------------------|
| Operating Voltage   | $V_{AC}$ | Ta= 25°C  | -    | 100  | -    | $V_{RMS}$          |
| Frequency           | $f_O$    |   | -    | 400  | -    | Hz                 |
| Luminosity*         | L        | Ta= 25°C<br>$V_{AC} = 100 V_{RMS}$<br>$f_O = 400Hz$ | 40   | -    | -    | cd/m <sup>2</sup>  |
| Current Consumption | I        |   | -    | -    | 0.2  | mA/cm <sup>2</sup> |
| C.I.E.of 1931       | X        |   | 0.15 | 0.18 | 0.21 | -                  |
|                     | Y        |   | 0.35 | 0.38 | 0.41 | -                  |
| Lifetime            | -        |   | -    | 2000 | -    | HRs                |
| Color               | -        | Blue Green  |      |      |      |                    |

\*The luminosity is measured from the surface of EL only.

\*\* Time to half luminance.



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### 3. Optical Specifications

#### 3.1 LCD Driving Voltage Recommended

| Parameter                  | Symbol         | Conditions                        | Min.  | Typ.  | Max.  | Units |
|----------------------------|----------------|-----------------------------------|-------|-------|-------|-------|
| LCD Driving Voltage Note 1 | $V_O - V_{SS}$ | $T_a = -20\text{ }^\circ\text{C}$ | --    | 21.11 | --    | V     |
|                            |                | $T_a = 25\text{ }^\circ\text{C}$  | 17.89 | 18.49 | 19.09 | V     |
|                            |                | $T_a = 70\text{ }^\circ\text{C}$  | --    | 16.28 | --    | V     |

Note 1 : Voltage (Applied actual waveform to LCD Module) for the best contrast. The range of minimum and maximum shows tolerance of the operating voltage. The specified contrast ratio and response time are not guaranteed over the entire range.

#### 3.2 Optical Characteristics

$T_a=25\text{ }^\circ\text{C}$ , 1/160 Duty, 1/13 Bias, (Note 4),  $\theta = 0^\circ$ ,  $\phi = -^\circ$

| Parameter                                    | Symbol       | Conditions                               | Min.                              | Typ.      | Max. | Units |       |
|--|--------------|--|-----------------------------------|-----------|------|-------|-------|
| Contrast Ratio Note 1                        | C            | $\theta = 0^\circ$ , $\phi = 0^\circ$    | --                                | 3.0       | --   | --    |       |
| Viewing Angle. $CR \geq 2$<br>(Shown in 3.3) | Front-Back   | $\theta_r - \theta_b$ , $\phi = 0^\circ$ | +38                               | to        | -29  | deg.  |       |
|  | Left-Right   | $\theta_l - \theta_r$ , $\phi = 0^\circ$ | +30                               | to        | -32  | deg.  |       |
| Response Time                                | Rise Note 2  | $T_{ON}$                                 | $T_a = -20\text{ }^\circ\text{C}$ | --        | 2010 | 4020  | msec  |
|  | Decay Note 3 |  |                                   | $T_{OFF}$ | --   | 8200  | 16400 |
|  | Rise Note 2  | $T_{ON}$                                 | $T_a = 25\text{ }^\circ\text{C}$  | --        | 140  | 280   | msec  |
|  | Decay Note 3 |  |                                   | $T_{OFF}$ | --   | 255   | 510   |
|  | Rise Note 2  | $T_{ON}$                                 | $T_a = 70\text{ }^\circ\text{C}$  | --        | 75   |       | msec  |
|  | Decay Note 3 |  |                                   | $T_{OFF}$ | --   | 100   |       |

Note 1 : Contrast ratio is defined as follows.

$$CR = L_{OFF} / L_{ON}$$

$L_{ON}$  : Luminance of the ON segments,  $L_{OFF}$  : Luminance of the OFF segments

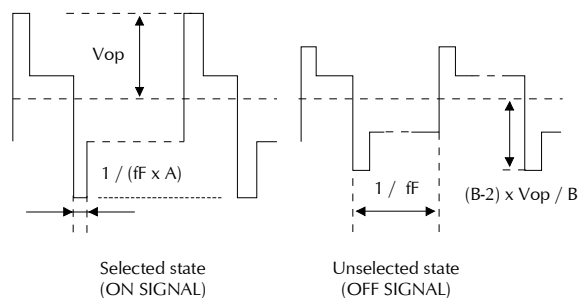
Note 2 : The time that the luminance level reaches 90% of the saturation level from 0% when ON signal is applied.

Note 3 : The time that the luminance level reaches 10% of the saturation level from 100% when OFF signal is applied.

Note 4 : Definition of Driving Voltage  $V_D$ . Assuming that the typical driving waveforms shown below are applied to the LCD Panel at 1/A Duty - 1/B Bias ( A : Duty Number, B : Bias Number ). Driving voltage  $V_D$  is defined as follows:  $V_D = (V_{th1} + V_{th2}) / 2$

$V_{th1}$  : The voltage VO-P that should provide 50% of the saturation level in the luminance at the segment which the ON signal is applied to.

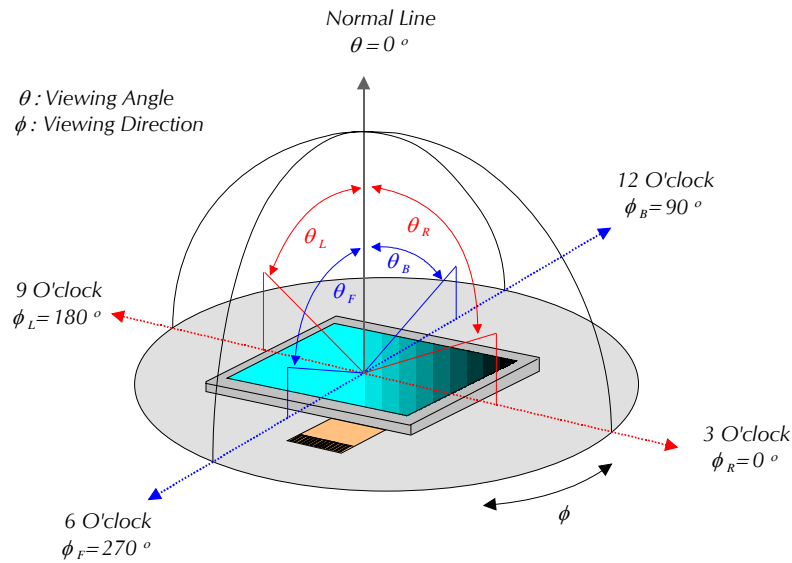
$V_{th2}$  : The voltage VO-P that should provide 50% of the saturation level in the luminance at the segment which the OFF signal is applied to.



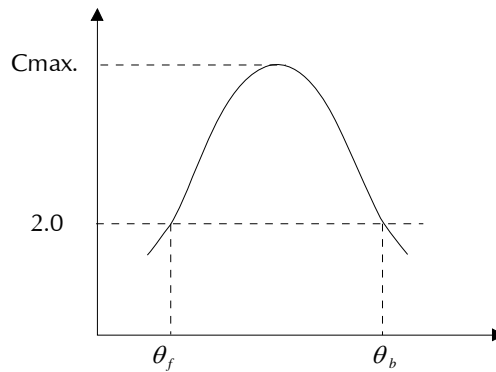
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### 3.3 Definition of Viewing Angle and Optimum Viewing Area



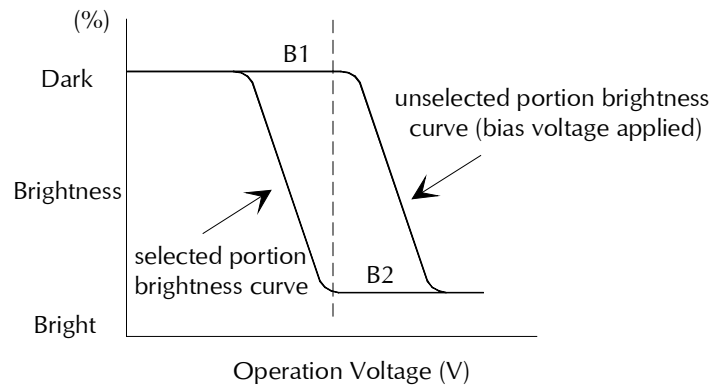
### 3.4 Definition of Viewing Angle $\theta_f$ and $\theta_b$



Viewing angles  $\theta$  ( $\phi$  fixed)

Optimum viewing angle with the naked eye and viewing angle  $\theta$  at Cmax. Above are not always the same.

### 3.5 Definition of Contrast C, $C = \text{Brightness of selected dot (B1)} / \text{Brightness of unselected dot (B2)}$



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#### 4. I/O Terminal

##### 4.1 Pin Assignment

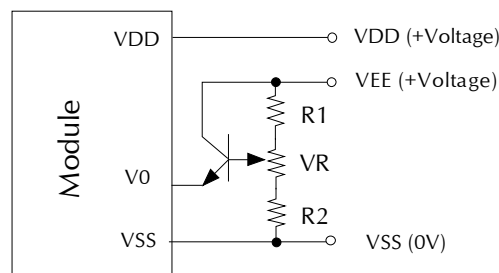
| No. | Symbol          | Level | Function   |
|-----|-----------------|-------|--|
| 1   | V5              | -     | Power supply for LCD drive                             |
| 2   | V2              | -     | Power supply for LCD drive                             |
| 3   | V <sub>EE</sub> | -     | Power supply for LCD drive                             |
| 4   | V <sub>DD</sub> | -     | Power supply for logic system                          |
| 5   | FLM             | I/O   | Input/output for chip select or data of shift register |
| 6   | F_GND           | -     | Frame Ground.  |
| 7   | Load            | I     | Latch pulse input/shift clock input for shift register |
| 8   | V <sub>SS</sub> | -     | Ground pin connects to 0V                              |
| 9   | DF              | I     | AV converting signal input for LCD drive waveform      |
| 10  | DISP            | I     | Control input pin for output deselect level            |
| 11  | CP              | I     | Display data shift clock input for segment mode        |
| 12  | V4              | -     | Power supply for LCD drive                             |
| 13  | V3              | -     | Power supply for LCD drive                             |
| 14  | DB3             | I     | Display Data   |
| 15  | DB2             | I     | Display Data   |
| 16  | DB1             | I     | Display Data   |
| 17  | DB0             | I     | Display Data   |
| 18  | N/C             | -     | No connection  |

##### EL pin out

| No. | Symbol | Level | Function                |
|-----|--------|-------|-------------------------|
| 1   | EL 1   | -     | Power supply for EL B/L |
| 2   | EL 2   | -     | Power supply for EL B/L |

##### 4.2 Example of Power Supply

It is recommended to apply a potentiometer for the contrast adjust due to the tolerance of the driving voltage and its temperature dependence.



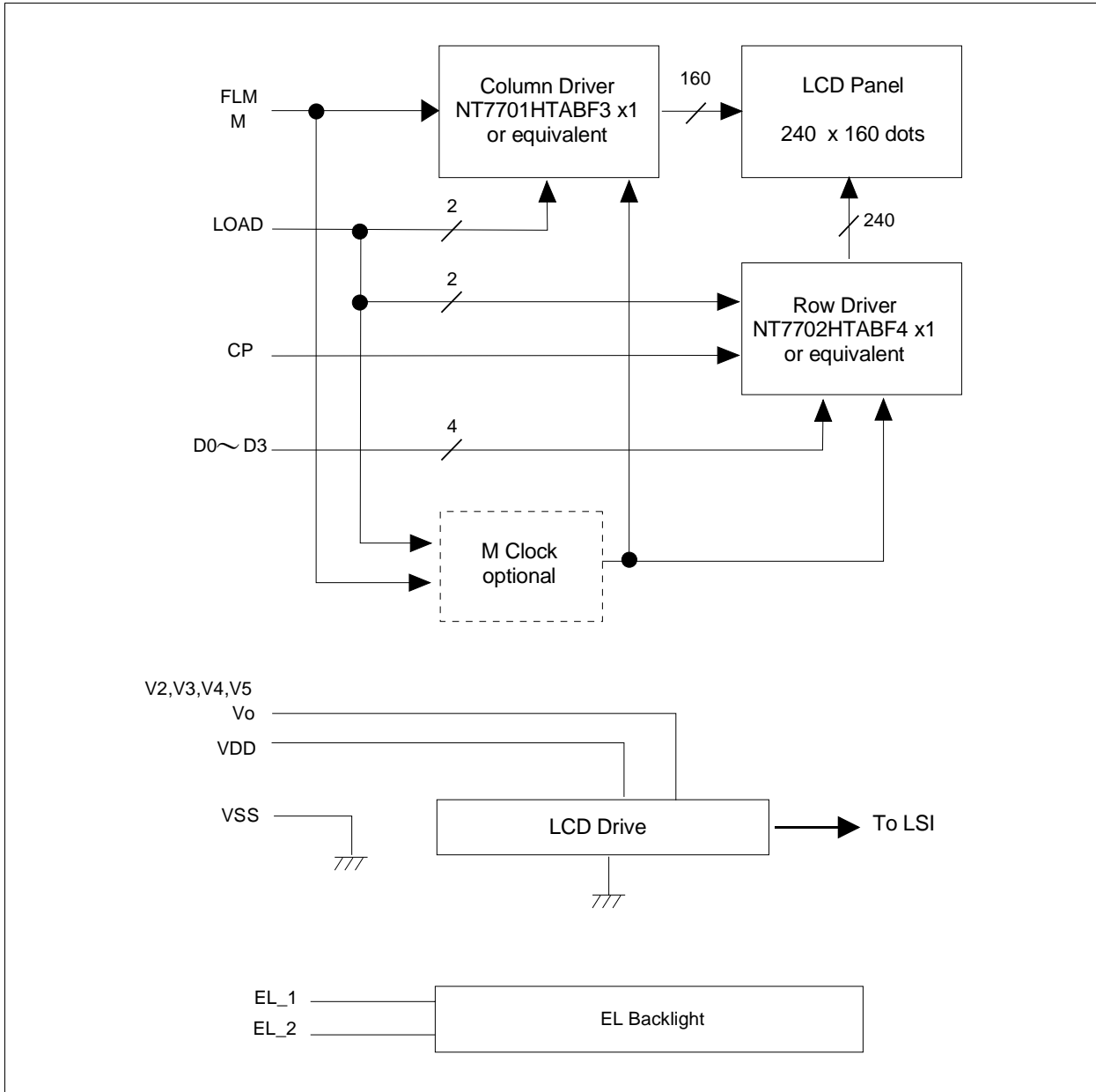
$$R1+R2+VR=10 \sim 20K$$

$$Tr = 2SA1202 \text{ or equivalent}$$



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4.3 Block Diagram

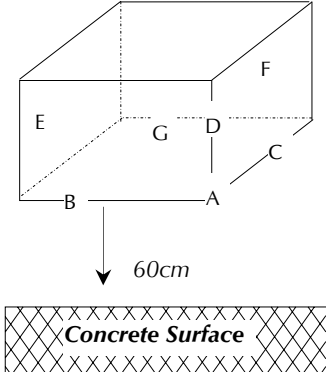


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## 5. Reliability Test

### 5.1 Test Item

No change on display and in operation under the following test condition.

| No. | Test Item                    | Description   | Condition                  | Note |
|-----|------------------------------|---|----------------------------|------|
| 1.  | High Temperature (Operation) | Durability test under long time high temperature with electrical stress (voltage, current)  | 70°C ± 2°C 96hrs           |      |
| 2.  | High Temperature (Storage)   | Durability test under long time high temperature storage  | 80°C ± 2°C 96hrs           | 4    |
| 3.  | Low Temperature (Operation)  | Durability test under long time low temperature with electrical stress (voltage, current)   | -20°C ± 2°C, 96hrs         | 3    |
| 4.  | Low Temperature (Storage)    | Durability test under long time low temperature storage   | -30°C ± 2°C, 96hrs         | 3, 4 |
| 5.  | Damp Proof Test              | Durability test under long time high temperature and high humidity  | 40°C± 2°C, 80% RH<br>96hrs | 3, 4 |
| 6.  | Vibration Test               | Total fixed amplitude: 1.5mm<br>Vibration frequency: 10~55Hz<br>One cycle 60 seconds to 3 directions of X, Y, Z for each 15 minutes   | --                         | 5    |
| 7.  | Drop Test                    | To be measured after dropping from 60cm high on the concrete surface in packing state.<br><br><i>Dropping method corner dropping</i><br>A corner: once<br><i>Edge dropping</i><br>B, C, D edge: once<br><i>Face dropping</i><br>E, F, G face: once |                            |      |

Note 1: Unless otherwise specified, tests will be conducted under the following condition,

Temperature : 25°C ± 2°C

Humidity : 65% ± 5%

Note 2: Unless otherwise specified, tests will be not conducted under functioning state.

Note 3: No dew condensation to be observed.

Note 4: The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

Note 5: Vibration test will be conducted to the product itself without putting it in a container.



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## 5.2 Judgment Standard

| Failure Mode         | Test Item |   |   |   |   |   |   | Judgment Standard  |
|----------------------|-----------|---|---|---|---|---|---|--|
|                      | 1         | 2 | 3 | 4 | 5 | 6 | 7 |  |
| Orientation          | *         | * | * | * | * |   |   | No remarkable degradation of appearance under bias/ non-bias condition             |
| Current Value (IAC)  | *         | * | * | * | * |   |   | No remarkable increase   |
| Contrast             | *         |   | * | * | * |   |   | No remarkable poor contrast  |
| Domain               | *         | * | * | * | * |   |   | Less than 20% of all dots have reverse tilt of more than on third of one dot area. |
| Bubble (Inside Cell) | *         | * | * | * | * | * |   | As per "Appearance Standard" (Note. Including one which disappear after 25°C 2H)   |
| Polarizer            | *         |   |   |   | * | * |   | As per "Appearance Standard" no remarkable appearance change                       |
| Glass Damage         |           |   |   |   |   |   | * | As per "Appearance Standard"   |

Note.1. \* is strong linkage between Failure Mode and Test Item.

2. Number of Test Item should be referred to former page.

3. Judgment and Standard value should be fixed by other inspection standard and criteria samples.



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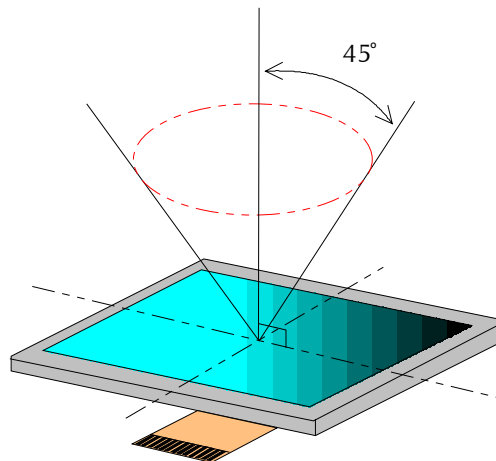


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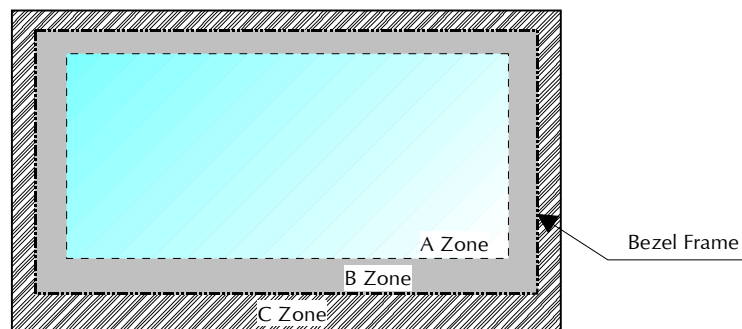
## 6. Appearance Standards

### 6.1 Inspection Conditions

The LCD shall be inspected under 40W white fluorescent light. The distance between the eyes and the sample shall be more than 30cm. All directions for inspecting the sample should be within 45° against perpendicular line.



### 6.2 Definition of Applicable Zones



A Zone : Active display area

B Zone : Area from outside of "A Zone" to validity viewing area

C Zone : Rest parts

A Zone + B Zone = Validity viewing area



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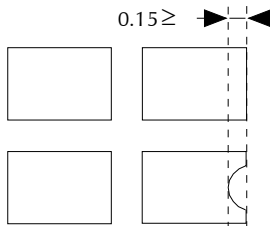
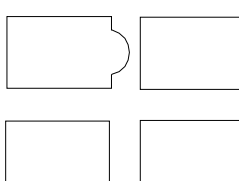
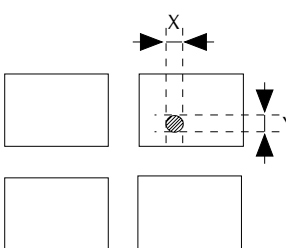
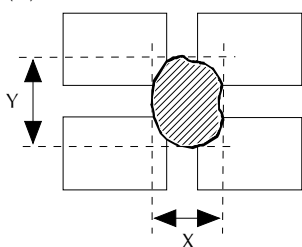
### 6.3 Standards

| No.                   | Parameter                                 | Criteria   |                       |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
|-----------------------|---|--|-----------------------|-------------------|--|--|---|---|---|---------|---|---|---|---------------|---|---|---|---------------|---|---|---|---------------|---|---|---|---------|---|---|---|---------------|---------------|-------------------|--|--|---|---|---|----|----------|---|---|---|---------|----------|---|---|---|---------|---------|---|---|---|----|---------|---------------------|--|--|
| 1.                    | Black and White Spots, Foreign Substances | <p>(1) Round Shape</p> <table border="1"> <thead> <tr> <th rowspan="2">Dimension (mm) \ Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>D ≤ 0.2</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.2 &lt; D ≤ 0.3</td> <td>3</td> <td>5</td> <td>*</td> </tr> <tr> <td>0.3 &lt; D ≤ 0.4</td> <td>2</td> <td>3</td> <td>*</td> </tr> <tr> <td>0.4 &lt; D ≤ 0.5</td> <td>0</td> <td>1</td> <td>*</td> </tr> <tr> <td>0.5 &lt; D</td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>D = (Long + Short)/2    *: Disregard</p> <p>(2) Line Shape</p> <table border="1"> <thead> <tr> <th rowspan="2">Zone \ X (mm)</th> <th rowspan="2">Zone \ Y (mm)</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>--</td> <td>0.03 ≥ W</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>2.0 ≥ L</td> <td>0.05 ≥ W</td> <td>3</td> <td>3</td> <td>*</td> </tr> <tr> <td>1.0 ≥ L</td> <td>0.1 ≥ W</td> <td>3</td> <td>3</td> <td>*</td> </tr> <tr> <td>--</td> <td>0.1 &lt; W</td> <td colspan="3">In the same way (1)</td> </tr> </tbody> </table> <p>X : Length    Y: Width    *: Disregard</p> <p>Total defects shall not exceed 5.</p> | Dimension (mm) \ Zone | Acceptable Number |  |  | A | B | C | D ≤ 0.2 | * | * | * | 0.2 < D ≤ 0.3 | 3 | 5 | * | 0.3 < D ≤ 0.4 | 2 | 3 | * | 0.4 < D ≤ 0.5 | 0 | 1 | * | 0.5 < D | 0 | 0 | * | Zone \ X (mm) | Zone \ Y (mm) | Acceptable Number |  |  | A | B | C | -- | 0.03 ≥ W | * | * | * | 2.0 ≥ L | 0.05 ≥ W | 3 | 3 | * | 1.0 ≥ L | 0.1 ≥ W | 3 | 3 | * | -- | 0.1 < W | In the same way (1) |  |  |
| Dimension (mm) \ Zone | Acceptable Number                         |  |                       |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
|                       | A   | B  | C                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| D ≤ 0.2               | *   | *  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.2 < D ≤ 0.3         | 3   | 5  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.3 < D ≤ 0.4         | 2   | 3  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.4 < D ≤ 0.5         | 0   | 1  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.5 < D               | 0   | 0  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| Zone \ X (mm)         | Zone \ Y (mm)                             | Acceptable Number  |                       |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
|                       |   | A  | B                     | C                 |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| --                    | 0.03 ≥ W                                  | *  | *                     | *                 |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 2.0 ≥ L               | 0.05 ≥ W                                  | 3  | 3                     | *                 |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 1.0 ≥ L               | 0.1 ≥ W                                   | 3  | 3                     | *                 |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| --                    | 0.1 < W                                   | In the same way (1)  |                       |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 2.                    | Air Bubbles (between glass & polarizer)   | <table border="1"> <thead> <tr> <th rowspan="2">Dimension (mm) \ Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>D ≤ 0.3</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.3 &lt; D ≤ 0.4</td> <td>3</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.4 &lt; D ≤ 0.6</td> <td>2</td> <td>3</td> <td>*</td> </tr> <tr> <td>0.6 &lt; D</td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>*: Disregard</p> <p>Total defects shall not exceed 3.</p>   | Dimension (mm) \ Zone | Acceptable Number |  |  | A | B | C | D ≤ 0.3 | * | * | * | 0.3 < D ≤ 0.4 | 3 | * | * | 0.4 < D ≤ 0.6 | 2 | 3 | * | 0.6 < D       | 0 | 0 | * |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| Dimension (mm) \ Zone | Acceptable Number                         |  |                       |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
|                       | A   | B  | C                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| D ≤ 0.3               | *   | *  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.3 < D ≤ 0.4         | 3   | *  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.4 < D ≤ 0.6         | 2   | 3  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |
| 0.6 < D               | 0   | 0  | *                     |                   |  |  |   |   |   |         |   |   |   |               |   |   |   |               |   |   |   |               |   |   |   |         |   |   |   |               |               |                   |  |  |   |   |   |    |          |   |   |   |         |          |   |   |   |         |         |   |   |   |    |         |                     |  |  |

To be continued.....



|                       |        |                       |          |              |         |
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| No. | Parameter  | Criteria   |
|-----|--|--|
| 3.  | The Shape of Dot                                     | <p>(1) Dot Shape (with Dent)</p>  <p>As per the sketch of left hand.</p> <p>(2) Dot Shape (with Projection)</p>  <p>Should not be connected to next dot.</p> <p>(3) Pin Hole</p>  <p><math>(X+Y)/2 \leq 0.2\text{mm}</math> (Less than 0.1mm is no counted.)</p> <p>(4) Deformation</p>  <p><math>(X+Y)/2 \leq 0.2\text{mm}</math></p> <p>Total acceptable number: 1/dot, 5/cell<br/>(Defect number of (4): 1pc.)</p> |
| 4.  | Polarizer Scratches                                  | Not to be conspicuous defects.   |
| 5.  | Polarizer Dirts                                      | If the stains are removed easily from LCDP surface, the module is not defective.   |
| 6.  | Complex Foreign Substance Defects                    | Black spots, line shaped foreign substance or air bubbles between glass & polarizer should be 5pcs maximum in total.   |
| 7.  | Distance between different Foreign Substance defects | $D \leq 0.2$ : 20mm or more<br>$0.2 < D$ : 40mm or more  |



|                       |        |                       |          |              |         |
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## 7. Handling and Precautions

The Following precautions will guide you in handling our product correctly.

- 1 Liquid crystal display devices
  - 1.1 The liquid crystal display device panel used in the liquid crystal display module is made of plate glass. Avoid any strong mechanical shock. Should the glass break handle it with care.
  - 1.2 The polarizer adhering to the surface of the LCD is made of a soft material. Guard against scratching it.
- 2 Care of the liquid crystal display module against static electricity discharge.
  - 2.1 When working with the module, be sure to ground your body and any electrical equipment you may be using. We strongly recommend the use of anti static mats ( made of rubber ), to protect work tables against the hazards of electrical shock.
  - 2.2 Avoid the use of work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
  - 2.3 Slowly and carefully remove the protective film from the LCD module, since this operation can generate static electricity.
- 3 When the LCD module alone must be stored for long periods of time:
  - 3.1 Protect the modules from high temperature and humidity.
  - 3.2 Keep the modules out of direct sunlight or direct exposure to ultra-violet rays.
  - 3.3 Protect the modules from excessive external forces.
- 4 Use the module with a power supply that is equipped with an over current protector circuit, since the module is not provided with this protective feature.
- 5 Do not ingest the LCD fluid itself should it leak out of a damaged LCD module. Should hands or clothing come in contact with LCD fluid, wash immediately with soap.
- 6 Conductivity is not guaranteed for models that use metal holders where solder connections between the metal holder and the PCB are not used. Please contact us to discuss appropriate ways to assure conductivity.



|                       |        |                       |          |              |         |
|-----------------------|--------|-----------------------|----------|--------------|---------|
| Messrs. Standard      |        |                       |          |              |         |
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## 8. 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.

## 9. Dimensional Outlines

- See the next page.....



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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».



## JONHON

«**JONHON**» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

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