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| REVISIONS |                        |          |          |
|-----------|------------------------|----------|----------|
| REV.      | DESCRIPTION            | DATE     | APPROVED |
| -         | RELEASED ON ECN #E0771 | 12/15/98 | MA       |

1. **Specification subject to change without notice.**
2. **All dimensions and specifications apply to standard modules. This information may vary for modules with optional features.**
3. **All dimensions are in millimeters.**
4. **Precautions: These precautions apply equally to modules from all makers, not just Densitron. Violation of these guidelines may void the warranty and can cause problems ranging from erratic operation to catastrophic display failure.**

*Handling precautions:*

- ◆ This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.

*Power supply precautions:*

- ◆ Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
- ◆ Prevent the application of reverse polarity to VDD and Vss, however briefly.
- ◆ Use a clean power source free from transients. Power up conditions are occasionally "jolting" and may exceed the maximum ratings of the module.
- ◆ The +5V power of the module should also supply the power to all devices which may access the display. Don't allow the data bus to be driven when the logic supply to the module is turned off.
- ◆ DO NOT install a capacitor between the Vo (contrast) pin and ground. VDD must, at all times, exceed the Vo voltage level. The capacitor combines with the contrast potentiometer to form an R-C network which "holds-up" Vo, at power-down, possibly damaging the module.

*Operating precautions:*

- ◆ DO NOT plug or unplug the module when the system is powered up.
- ◆ Minimize the cable length between the module and host MPU. (Recommended max. length 30 cm).
- ◆ For models with EL or CCFL backlights, do not disable the backlight by interrupting the HV line. Unloaded inverters produce voltage extremes which may arc within a cable or at the display.
- ◆ Operate the module within the limits of the modules temperature specifications.

*Mechanical / Environmental precautions:*

- ◆ Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the elastomeric connection and cause display failure. Densitron recommends the use of Kester "245" no-clean solder.
- ◆ Mount the module so that it is free from torque and mechanical stress.
- ◆ Surface of LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
- ◆ ALWAYS employ anti-static procedure while handling the module.
- ◆ Prevent moisture build-up upon the module and observe the environmental constraints for storage temperature and humidity.
- ◆ DO NOT store in direct sunlight.
- ◆ If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap.

**Notes:** (unless otherwise specified)

|                                                                                                                                                |           |      |                               |               |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|-------------------------------|---------------|
| Unless otherwise specified:<br><br>Dimensions are mm<br>Tolerances are:<br>X = $\pm 3$<br>.X = $\pm 0.5$<br>.XX = $\pm 0.05$<br>FSCM NO. 62483 | APPROVALS | DATE | DENSITRON INTERNATIONAL PLC.  |               |
|                                                                                                                                                | DRAWN     |      |                               |               |
|                                                                                                                                                | CHECKED   |      | TITLE                         |               |
|                                                                                                                                                | ISSUED    |      | DWG. NO.                      |               |
|                                                                                                                                                |           |      | 320 X 240 GRAPHICS LCD MODULE |               |
|                                                                                                                                                |           |      | PM0149                        | SHEET 1 OF 12 |

## 1.0 GENERAL SPECIFICATION

| ITEM                     | CONTENT                       |
|--------------------------|-------------------------------|
| Display content          | 320(H) x 240(W)               |
| Dimensional Outline [mm] | 92.2(H)X72.3(W)X7.8max.(D)    |
| Display mode             | Transflective Type            |
| Surface treatment        | Anti-glare with hard coat     |
| Circuit                  | X-driver, Y-driver            |
| Interface                | Data (D0~D3), SCP,LP,FP,VEE,M |

## 2.0 MECHANICAL CHARACTERISTICS

|                       |                |                                                |
|-----------------------|----------------|------------------------------------------------|
| (1) Product No.       |                | CLS-040S-C3M                                   |
| (2) Module Size       |                | 72.3(mm x 92.2(H) mm x Max 7.8(D)mm            |
| (3) Dot Size          |                | 0.22(W)mm x 0.22(H)mm                          |
| (4) Dot Pitch         |                | 0.24(W)mm x 0.24(H)mm                          |
| (5) Number of Dots    |                | 240(W) x 320(H)Dots                            |
| (6) Duty              |                | 1/240                                          |
| (7) Bias              |                | 1/13                                           |
| (8) LCD Display Mode  | FSTN           | Black and White(Normally White/Positive Image) |
|                       | Rear Polarizer | Transflective                                  |
| (9) Viewing direction |                | 6 O'clock                                      |
| (10) Backlight        |                | EL                                             |
| (11) Controller       |                | Without                                        |
| (12) DC/DC Converter  |                | Without                                        |
| (13) Weight           |                | W/O B/L: 50g (approx.)                         |

## 3.0 ABSOLUTE MAXIMUM RATINGS

| ITEM                   | SYMBOL   | MIN. | MAX. | UNIT | NOTE   |
|------------------------|----------|------|------|------|--------|
| Power Supply for Logic | VDD -VSS | -0.3 | 6.5  | V    |        |
| Power Supply for LCD   | VEE -VSS | 0    | 26   | V    |        |
| Input Voltage          | VI       | -0.3 | VDD  | V    |        |
| Static Electricity     | -        | -    | -    | -    | Note 1 |

**Notes:** 1: LCM should be grounded during handling LCM.

### (3) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM                            | NORMAL TEMP. |          | WIDE TEMP. |          |
|---------------------------------|--------------|----------|------------|----------|
|                                 | OPERATING    | STORAGE  | OPERATING  | STORAGE  |
|                                 | MIN MAX      | MIN MAX  | MIN MAX    | MIN MAX  |
| Ambient Temperature             | 0 50         | -20 70   | -20 70     | -30 80   |
| Humidity (without condensation) | Note 2,4     | Note 3,5 | Note 4,5   | Note 4,6 |

Note 2 Ta ≤ 50 °C:85%RH max

Ta > 50 °C:Absolute humidity must be lower than the humidity of 85%RH at 50 °C

Note 3 Ta at -20 °C will be < 48hrs at 70 °C will be < 120hrs

Note 4 Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5 Ta ≤ 70 °C:75RH max

Ta > 70 °C:absolute humidity must be lower than the humidity of 75%RH at 70 °C

Note 6 Ta at -30 °C will be < 48hrs, at 80 °C will be < 120hrs

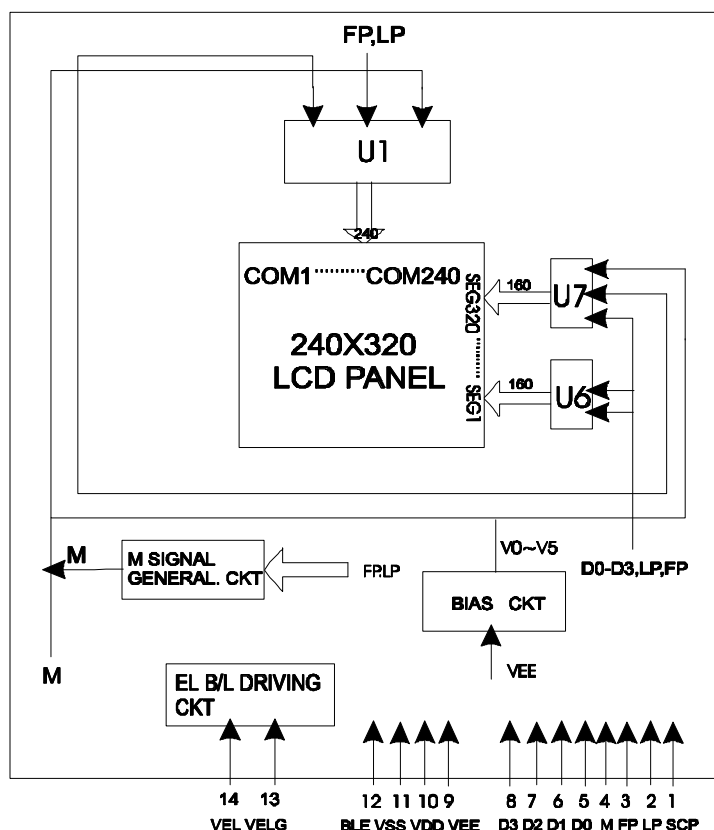
### 4.0 ELECTRO-OPTICAL CHARACTERISTICS

| ITEM                                     | SYMBOL           | CONDITION                                                                                   | MIN.   | TYP. | MAX    | UNIT   | NOTE |
|------------------------------------------|------------------|---------------------------------------------------------------------------------------------|--------|------|--------|--------|------|
| Power supply for Logic                   | VDD-VSS          | -                                                                                           | -      | 3.3  | 6.5    | V      |      |
| Input Voltage                            | VIL              | L level                                                                                     | VSS    |      | 0.2VDD | V      |      |
|                                          | VIH              | H level                                                                                     | 0.8VDD | VDD  | -      | V      |      |
| LCM Recommend LCD Module Driving Voltage | VEE-VSS          | VDD=5v Bias=1/13                                                                            | 0 °C   | -    | -      | V      |      |
|                                          |                  |                                                                                             | 25 °C  | 21.6 | -      |        |      |
|                                          |                  |                                                                                             | 50 °C  | -    | -      |        |      |
| Power Supply Current for LCM             | IDD (EL B/L OFF) | VDD=5.0V (Including EL And EL Driver)<br>VEE - VSS=21.6v<br>FLM=60Hz<br>VEL=5.0V<br>VELG=0V | -      | -    | 2.0    | mA     |      |
|                                          | IEL (EL B/L ON)  |                                                                                             | -      | -    | 30     |        |      |
|                                          | IEE              |                                                                                             | -      | -    | 3.0    |        |      |
| Viewing angle Range                      | θ f              | 25°C                                                                                        | -      | 15   | -      | Degree | 9    |
|                                          | θ b              |                                                                                             | -      | 30   | -      |        |      |
|                                          | θ l              |                                                                                             | -      | 35   | -      |        |      |
|                                          | θ r              |                                                                                             | -      | 35   | -      |        |      |
| Frame Frequency                          | Fr               |                                                                                             | -      | 64   | -      | Hz     |      |
| Response Time                            | Tr               | 25°C                                                                                        |        |      |        | ms     | 8    |
|                                          | Tf               |                                                                                             |        |      |        |        |      |
| Contrast                                 | K                | 25°C                                                                                        | -      | 5    | -      |        | 7    |

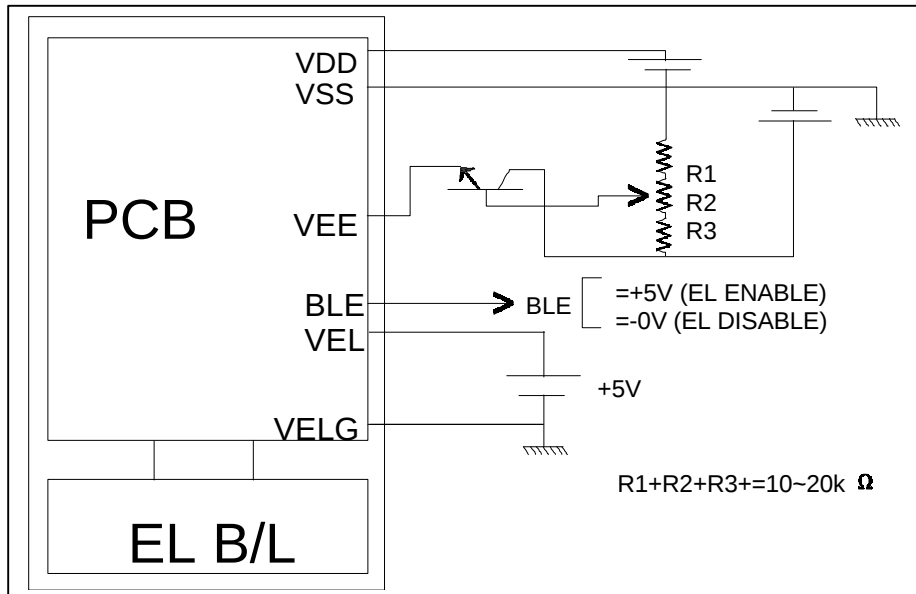
## 5.0 INTERFACE DESCRIPTION

| Pin No. | Symbol   | I/O | Function                                |
|---------|----------|-----|-----------------------------------------|
| 1       | CL2(SCP) | H/L | DATA SHIFT PULSE                        |
| 2       | CL1(LP)  | H/L | DATA LATCH PULSE                        |
| 3       | FLM      | H/L | SCAN START-UP SIGNAL                    |
| 4       | M (N.C.) | H/L | FRAME REVERSE SIGNAL (ALTERNATE SIGNAL) |
| 5       | D0       | H/L | DISPLAY DATA                            |
| 6       | D1       |     |                                         |
| 7       | D2       |     |                                         |
| 8       | D3       |     |                                         |
| 9       | VEE      | -   | POWER SUPPLY FOR LCD (+VE)              |
| 10      | VDD      | -   | POWER SUPPLY FOR LOGIC (+5V)            |
| 11      | Vss      | -   | POWER SUPPLY FOR LCD (0V)               |
| 12      | BLE      | H/L | H:EL ENABLE L: EL DISABLE               |
| 13      | VELG     |     | POWER SUPPLY FOR EL BACKLIGHT (GND, 0V) |
| 14      | VEL      |     | POWER SUPPLY FOR EL BACKLIGHT (+)       |

### 6.0BLOCK DIAGRAM:



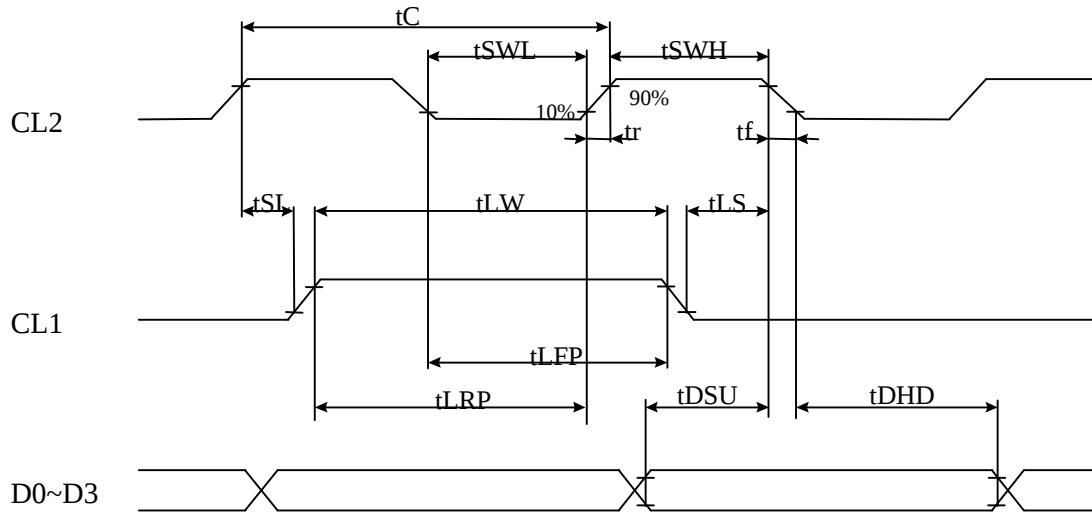
## 7. POWER SUPPLY



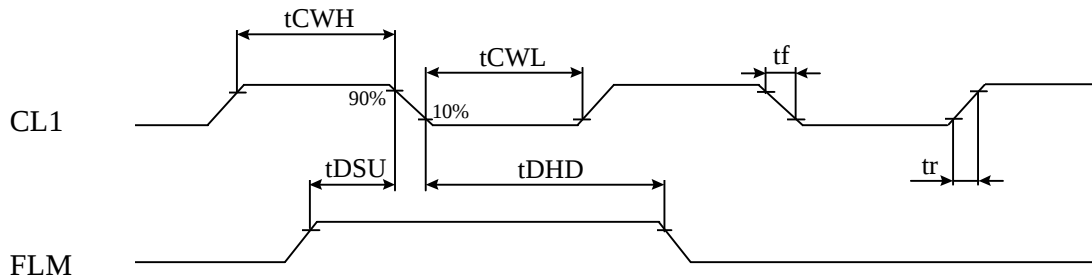
## 8. TIMING CHARACTERISTICS

### 8-1 COMMON & SEGMENT INTERFACE TIMING:

| ITEM                 | SYMBOL                         | TEST CONDITION | MIN. | TYP. | MAX. | UNITS |
|----------------------|--------------------------------|----------------|------|------|------|-------|
| Clock Cycle          | tC                             | Fig. 1         | 500  |      |      | ns    |
| SCP Pulse Width      | tSWH,tSWL                      | Fig. 1         | 240  |      |      | ns    |
| Data Set Up Time     | tDSU                           | Fig. 1 & 2     | 240  |      |      | ns    |
| Data Hold Time       | tDHD                           | Fig. 1 & 2     | 240  |      |      | ns    |
| SCP Rise/Fall Time   | t <sub>r</sub> ,t <sub>f</sub> | Fig. 1 & 2     |      |      | 50   | ns    |
| LP Rise Time         | tLRP                           | Fig. 1         | 240  |      |      | ns    |
| LP Fall Time         | tLFP                           | Fig. 1         | 240  |      |      | ns    |
| LP Pulse Width       | tLW                            | Fig. 1         | 240  |      |      | ns    |
| SCP To LP Delay Time | tSL                            | Fig. 1         | 50   |      |      | ns    |
| LP To SCP Delay Time | tLS                            | Fig. 1         | 100  |      |      | ns    |
| LP "H" Pulse Width   | tCWH                           | Fig. 2         | 40   |      |      | ns    |
| LP "L" Pulse Width   | tCWL                           | Fig. 2         | 170  |      |      | ns    |

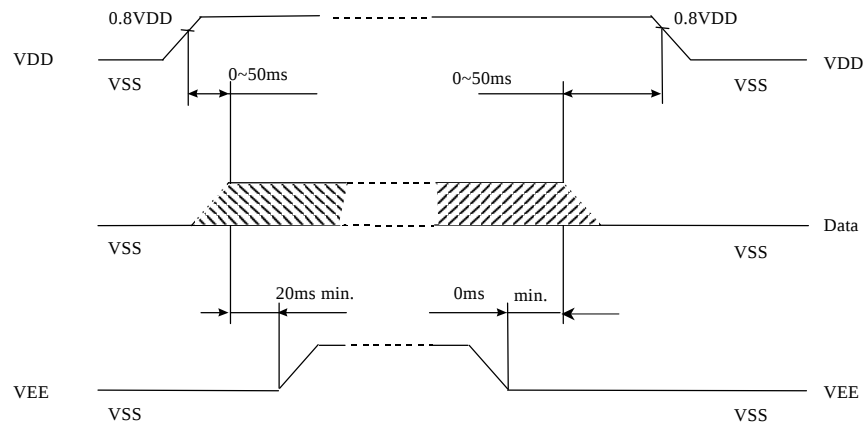


**Fig 1. SEGMENT TIMING**



**Fig 2 COMMON TIMING**

## 8.2 POWER ON/OFF TIMING

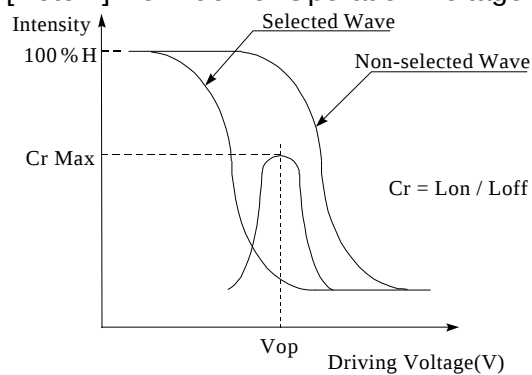


**POWER ON**

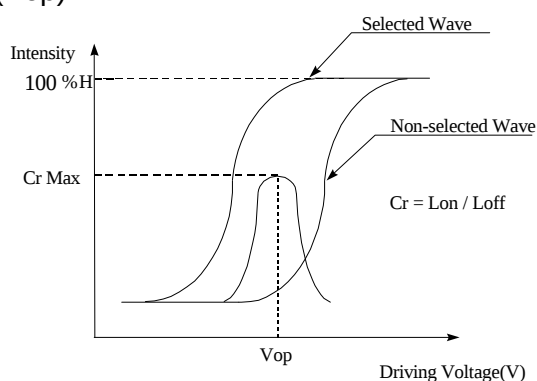
**POWER OFF**

\*Failure to comply with display power on/off timing may result in permanent damage to display driver circuits.

[Note 7] Definition of Operation Voltage (Vop)

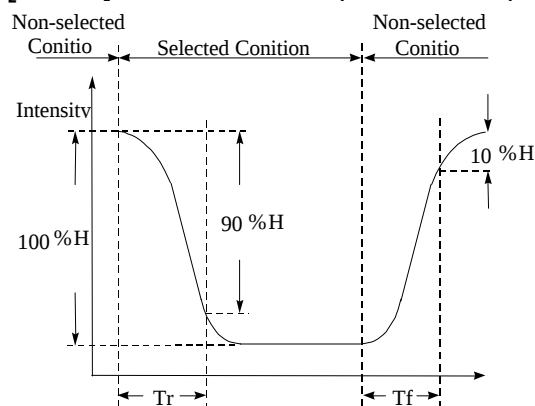


[Positive type]

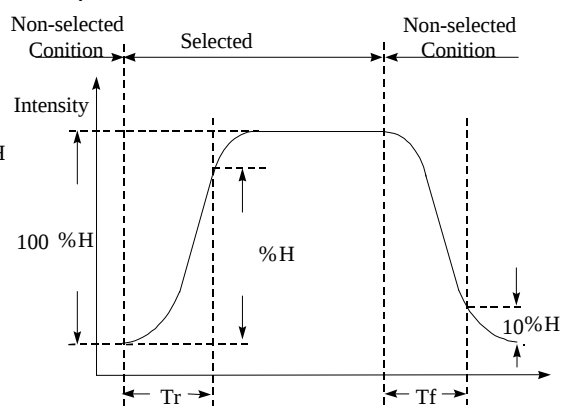


[Negative type]

[Note 8] Definition of Response Time ( Tr , Tf )



[Positive type]



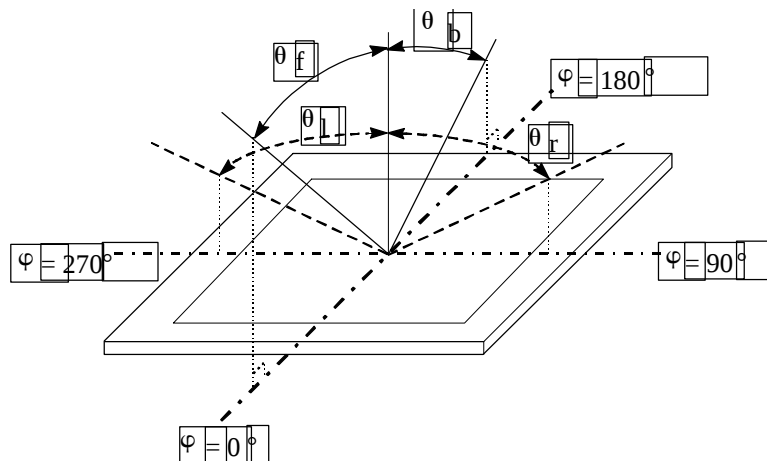
[Negative type]

Conditions :

Operating Voltage : Vop  
Frame Frequency : 64 HZ

Viewing Angle() : ( $\theta$ ,  $\phi$ ):0°,0°  
Driving Waveform : 1/N duty , 1/a bias

[Note 9] Definition of viewing angle(CR $\geq$ 2)

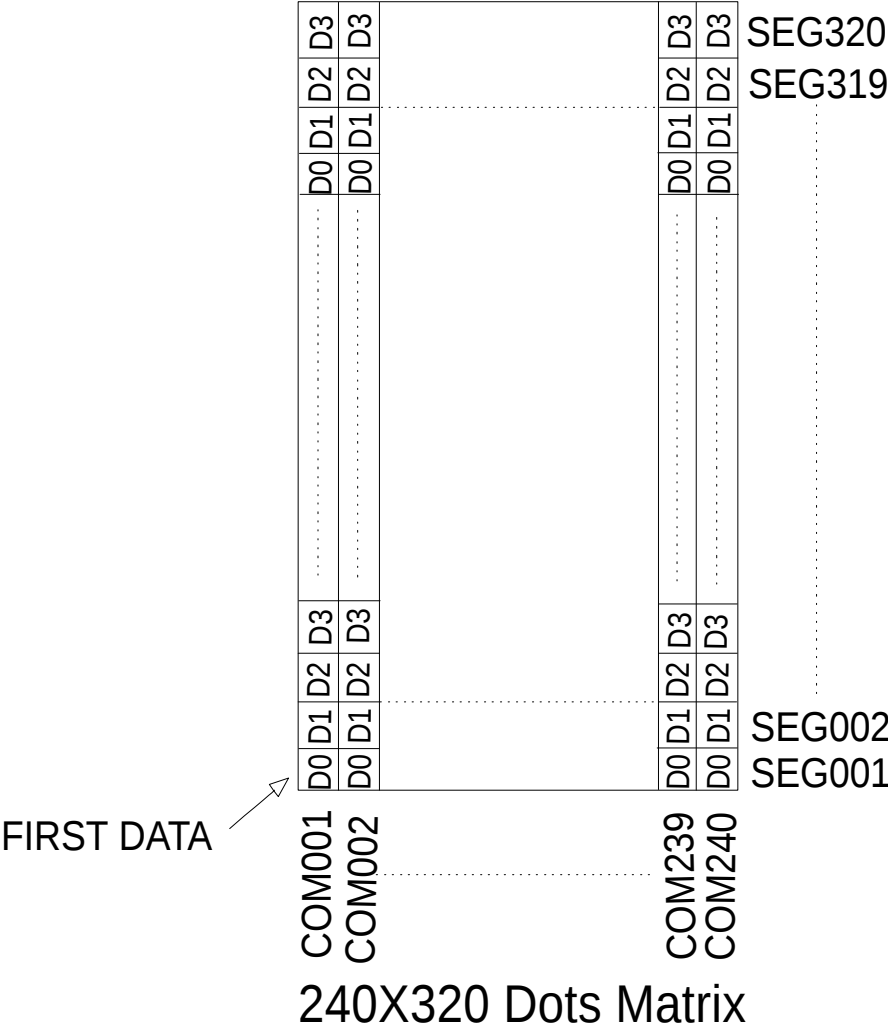


## 9.0 LCD PRODUCT QUALITY STANDARD

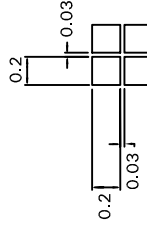
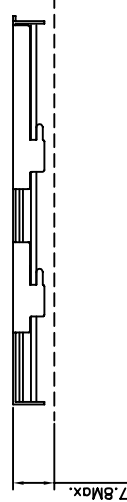
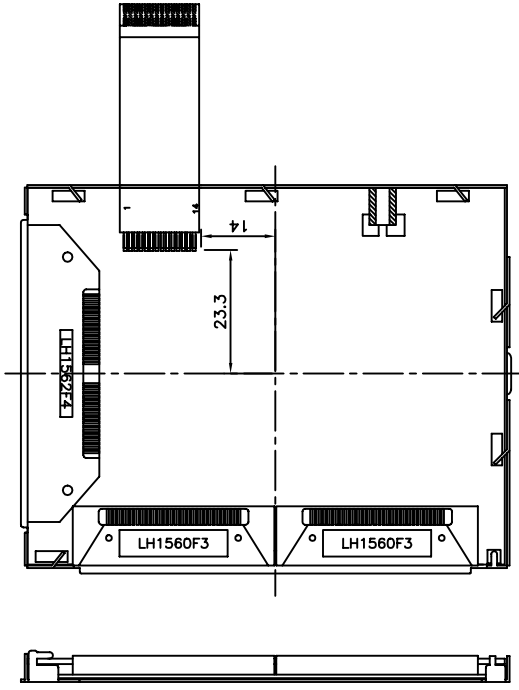
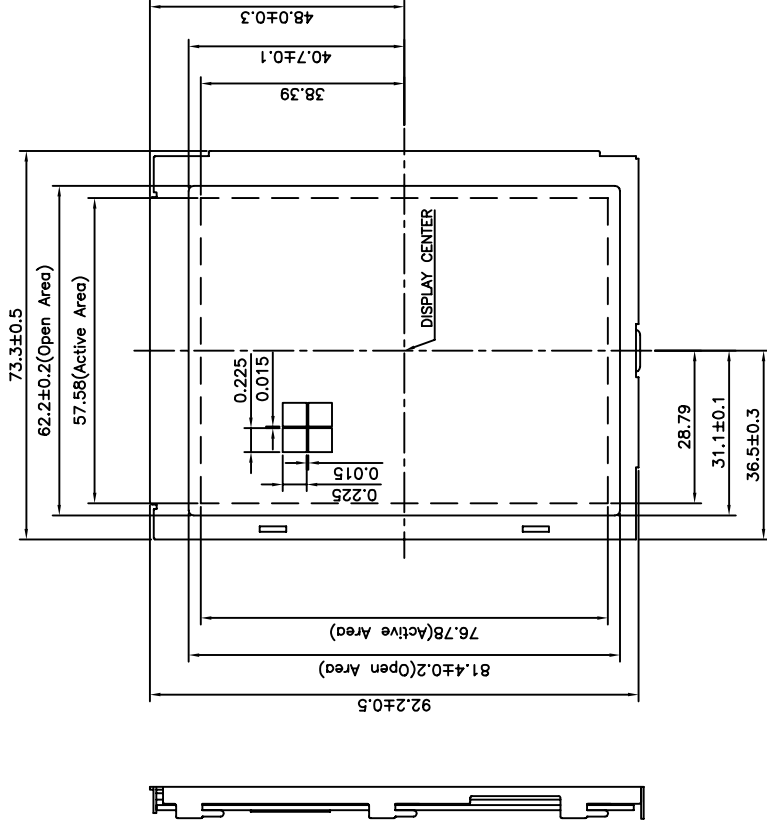
### DISPLAY APPEARANCE

| NO                                  | ITEM                                                | CRITERIA                                                                                                                                                                                                                                                                                                                                                                                                                                     | CLASS           |                |                                     |                          |              |             |               |                    |                                     |                      |       |
|-------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|-------------------------------------|--------------------------|--------------|-------------|---------------|--------------------|-------------------------------------|----------------------|-------|
| 1.                                  | INCLUSIONS<br>(BLACK SPOT,<br>WHITE SPOT ,<br>DUST) | <div>(1)ROUND TYPE<table><tr><th>DIAMETER mm(a*)</th><th>NO. OF DEFECT*</th></tr><tr><td>a ≤ 0.20<br/>0.20&lt;a ≤ 0.35<br/>0.35&lt;a</td><td>NEGLECT<br/>5 MAX<br/>NONE</td></tr></table></div> <div>(2)LINEAR TYPE<table><tr><th>LENGTH mm(L)</th><th>WIDTH mm(W)</th><th>NO. OF DEFECT</th></tr><tr><td>NA<br/>L ≤ 3<br/>3&lt;L</td><td>w ≤ 0.03<br/>0.03&lt;w ≤ 0.08<br/>0.08&lt;w</td><td>NEGLECT<br/>6<br/>NONE</td></tr></table></div> | DIAMETER mm(a*) | NO. OF DEFECT* | a ≤ 0.20<br>0.20<a ≤ 0.35<br>0.35<a | NEGLECT<br>5 MAX<br>NONE | LENGTH mm(L) | WIDTH mm(W) | NO. OF DEFECT | NA<br>L ≤ 3<br>3<L | w ≤ 0.03<br>0.03<w ≤ 0.08<br>0.08<w | NEGLECT<br>6<br>NONE | Minor |
| DIAMETER mm(a*)                     | NO. OF DEFECT*                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| a ≤ 0.20<br>0.20<a ≤ 0.35<br>0.35<a | NEGLECT<br>5 MAX<br>NONE                            |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| LENGTH mm(L)                        | WIDTH mm(W)                                         | NO. OF DEFECT                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| NA<br>L ≤ 3<br>3<L                  | w ≤ 0.03<br>0.03<w ≤ 0.08<br>0.08<w                 | NEGLECT<br>6<br>NONE                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 2.                                  | SCRATCH                                             | <div>1.SCRATCH ON PROTECTIVE FILM IS PERMITTED<br/>2.SCRATCH ON POLARIZER SHALL BE AS FOLLOWS:<br/>(1)ROUND TYPE<table><tr><th>DIAMETER mm(a*)</th><th>NO. OF DEFECT</th></tr><tr><td>a ≤ 0.15<br/>0.15&lt;a ≤0.20<br/>0.20&lt;a</td><td>NEGLECT<br/>2 MAX<br/>NONE</td></tr></table></div> <div>(2)LINEAR TYPE<br/>BE JUDGED BY 1.-(2)LINEAR TYPE</div>                                                                                     | DIAMETER mm(a*) | NO. OF DEFECT  | a ≤ 0.15<br>0.15<a ≤0.20<br>0.20<a  | NEGLECT<br>2 MAX<br>NONE | Minor        |             |               |                    |                                     |                      |       |
| DIAMETER mm(a*)                     | NO. OF DEFECT                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| a ≤ 0.15<br>0.15<a ≤0.20<br>0.20<a  | NEGLECT<br>2 MAX<br>NONE                            |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 3.                                  | DENT                                                | DIAMETER< 1.5mm                                                                                                                                                                                                                                                                                                                                                                                                                              | Minor           |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 4.                                  | BUBBLE                                              | NOT EXCEEDING 0.5mm AVERAGE DIAMETER IS ACCEPTABLE BETWEEN GLASS AND POLARIZING FILM.                                                                                                                                                                                                                                                                                                                                                        | Minor           |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 5.                                  | PIN HOLE                                            | (a+b)/2 ≤0.15MM<br>MAXIMUM NUMBER:IGNORED<br>0.15<(a+b)/2 ≤0.20mm<br>MAXIMUM NUMBER:10                                                                                                                                                                                                                                                                                                                                                       | Minor           |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 6.                                  | DOT DEFECT                                          | (a+b)/2 ≤ 0.20mm<br>MAXIMUM NUMBER:IGNORED<br>0.20<(a+b)/2 ≤ 0.30mm<br>MAXIMUM NUMBER:5<br>X=WIDTH                                                                                                                                                                                                                                                                                                                                           | Minor           |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 7.                                  | CONTRAST<br>IRREGULARITY<br>(SPOT)                  | <table><tr><th>DIAMETER SPEC</th><th>NO. OF DEFECT</th></tr><tr><td>a≤ 0.50mm</td><td>NEGLECT</td></tr><tr><td>0.50&lt;a≤ 0.75</td><td>5</td></tr><tr><td>0.75&lt;a ≤1.00</td><td>3</td></tr><tr><td>1.00&lt;a</td><td>NONE</td></tr></table>                                                                                                                                                                                                | DIAMETER SPEC   | NO. OF DEFECT  | a≤ 0.50mm                           | NEGLECT                  | 0.50<a≤ 0.75 | 5           | 0.75<a ≤1.00  | 3                  | 1.00<a                              | NONE                 | Minor |
| DIAMETER SPEC                       | NO. OF DEFECT                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| a≤ 0.50mm                           | NEGLECT                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 0.50<a≤ 0.75                        | 5                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 0.75<a ≤1.00                        | 3                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 1.00<a                              | NONE                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 8.                                  | DOT WIDTH                                           | DESIGN WIDTH 15%                                                                                                                                                                                                                                                                                                                                                                                                                             | Minor           |                |                                     |                          |              |             |               |                    |                                     |                      |       |
| 9.                                  | COLOR TONE<br>AND UNIFORMITY                        | OBVIOUS UNEVEN COLOR IS NOT PERMITTED                                                                                                                                                                                                                                                                                                                                                                                                        | Minor           |                |                                     |                          |              |             |               |                    |                                     |                      |       |

10. DISPLAY PATTERN



11.0 MODULE DIMENSIONS



|   |                       |                        |
|---|-----------------------|------------------------|
| 1 | Lcd Type              | FTN B/W                |
| 2 | Viewing Direction     | 6 O'clock              |
| 3 | Drive Method          | 1/240 Duty 1/13 Bias   |
| 4 | Operating Voltage     | 21V (25°C)             |
| 5 | Polarizer Mode        | Transflective/Positive |
| 6 | Operating Temperature | 0°C ~ 50°C             |
| 7 | Storage Temperature   | -20°C ~ 70°C           |
| 8 | Frame                 | 70Hz                   |

DWG. NO.

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REV.

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## 12. RELIABILITY TEST

| NO | ITEM                    | CONDITIONS                   |          | NOTE |
|----|-------------------------|------------------------------|----------|------|
| 1  | HIGH TEMP. Operation    | 50°C                         | 120 HR   |      |
| 2  | HIGH TEMP. Storage      | 60°C                         | 120 HR   |      |
| 3  | LOW TEMP. Operation     | 0°C                          | 120 HR   |      |
| 4  | LOW TEMP. Storage       | -20°C                        | 120 HR   |      |
| 5  | HIGH TEMP/HUMID Storage | 60°C<br>90% RH               | 120 HR   |      |
| 6  | THERMAL SHOCK           | -20°C, 30min<br>60°C, 30 min | 10 cycle |      |

### Definitions of life end point

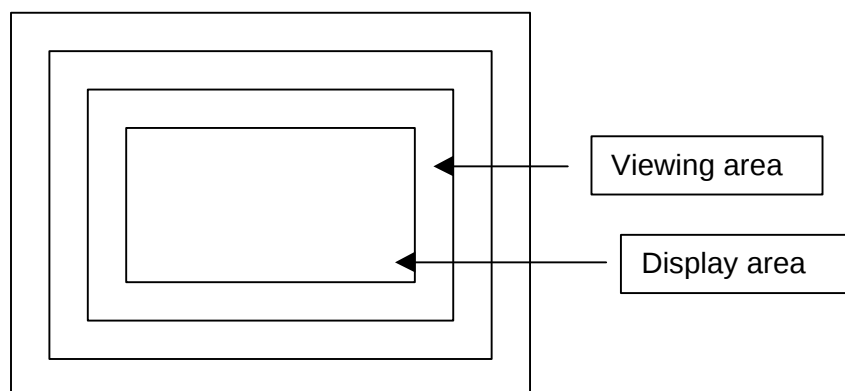
- 1) Current consumption is more than specified value
- 2) Function of the module is not maintained
- 3) There is visble degradation of appearance and display quality
- 4) Contrast ratio is less than 50% of specified value
- 5) Brightness is less than 50% of specified minimum value

**MTTF: LCD Module 5000 HR EL: 5000 HR**

## 13. APPEARANCE CHECK

### CONDITION OF APPEARANCE CHECK:

- 1) Eyes in distance of 30cm under 40w- fluorescent lamp shall check specimen.
- 2) Checking direction shall be in 45 degree from perpendicular line of specimen surface.



## 14. HANDLING PRECAUTIONS

- (1) Treat polarizer very carefully since it is easy to be damaged.
- (2) When cleaning the display surface, use soft cloth (e.g., gauze) With a solvent (recommended below) and wipe lightly.

- Ethyl alcohol
- Iso-propyl alcohol

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

Do not use the following solvents:

- Water
- Ketone
- Aromatics

- (3) Direct current causes electro-chemical reaction with remarkable degradation of the display quality. Give careful consideration to prevent direct current at ON/OFF timing and during operation.
- (4) Avoid strong shock and drop from a height.
- (5) To prevent LCD panels from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.
- (6) Give careful consideration to avoid electrical static discharge which causes uneven contrast.
- (7) Even a small condensation on the contact pads (terminals) causes electro-chemical reaction which makes missing rows and columns. Give careful attention to avoid condensation. When assembling with zebra connector, clean the surface of the pads with alcohol and keep the air very clean.