First Edition
Sep 5, 2005

# LCD Module Technical Specification

Final Revision
******

Type No.  **DMF-50840NB-FW-ASE-BFN**

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## Revision History

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## 1.General Specifications

Operating Temp.       :   min. 0°C ~max. 60°C

Storage Temp.        :   min. -20°C ~max. 60°C

Dot Pixels           :   320 (W) ×  240 (H) dots

Dot Size            :   0.33 (W) ×  0.33 (H) mm

Dot Pitch          :   0.36 (W) ×  0.36 (H) mm

Viewing Area        :   120.0 (W) ×  90.0 (H) mm

Outline Dimensions   :   167.1 (W) ×  109.0* (H) ×  11.0max.* (D) mm
                               *Without Connector
                               **Without CFL Cable

Weight             :   230g max.

LCD Type          :   NTD-15885
                               ( STN / Blue-mode / Transmissive )

Viewing Angle       :   6:00

Data Transfer       :   4-bit parallel data transfer

Backlight          :   Cold Cathode Fluorescent Lamp (CFL) ×  1

Additional Spec.     :   Electroplated Coating of Black-Zinc on Steel Holder Type

Drawings         :   Dimensional Outline    UE-36988A

RoHS regulation     :   To our best knowledge, this product satisfies material
                               requirement of RoHS regulation.
                               Our company is doing the best efforts to obtain
                               the equivalent certificate from our suppliers.

## 2.Electrical Specifications

### 2.1.Absolute Maximum Ratings

Vss=0V

| Parameter | Symbol | Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|
| Supply Voltage (Logic) | $V_{CC}$-$V_{SS}$ | - | -0.3 | 7.0 | V |
| Supply Voltage (LCD Drive) | $V_{CC}$-$V_{EE}$ | - | 0 | 35.0 | V |
| Input Voltage | $V_I$ | - | -0.3 | $V_{CC}$+0.3 | V |

### 2.2.DC Characteristics

Ta=25°C, Vss=0V

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Supply Voltage (Logic) | $V_{CC}$-$V_{SS}$ | - | 4.5 | - | 5.5 | V |
| Supply Voltage (LCD Drive) | $V_{CC}$-$V_{EE}$ | - | 26.4 | - | 30.0 | V |
| | $V_{CC}$-$V_{ADJ}$ | Shown in 3.1 | | | | V |
| High Level Input Voltage | $V_{IH}$ | $V_{CC}$=5.0V±10% | 0.8×$V_{CC}$ | - | $V_{CC}$ | V |
| Low Level Input Voltage | $V_{IL}$ | $V_{CC}$=5.0V±10% | 0 | - | 0.2×$V_{CC}$ | V |
| Supply Current | $I_{CC}$ | $V_{CC}$-$V_{SS}$=5.0V | - | 5.5 | 15.0 | mA |
| | $I_{EE}$ | $V_{CC}$-$V_{ADJ}$=23.3V | - | 5.0 | 10.0 | mA |

### 2.3. AC Characteristics

| Parameter | Symbol | Min. | Max. | Units |
|---|---|---|---|---|
| CP Frequency | $f_{CP}$ | - | 6.0 | MHz |
| Clock Pulse Width | $t_{WC}$ | 50 | - | ns |
| Latch Pulse Width | $t_{WL}$ | 63 | - | ns |
| Data Setup Time | $t_{SETUP}$ | 30 | - | ns |
| Data Hold Time | $t_{HOLD}$ | 30 | - | ns |
| Clock Pulse Setup Time | $t_{CL}$ | 80 | - | ns |
| Clock Pulse Hold Time | $t_{LC}$ | 0 | - | ns |
| Rise/Fall Time | $t_r, t_f$ | - | Note 1 | ns |
| FLM Setup Time | $t_{FDS}$ | 100 | - | ns |
| FLM Hold Time | $t_{FDH}$ | 100 | - | ns |

Note 1:The rise and fall times ($t_r, t_f$ ) must satisfy the following relationships.

$$t_r, t_f \leq \frac{1}{2f_{CP}} - t_{WC}$$

$$t_r, t_f \leq 50 \text{ ns}$$
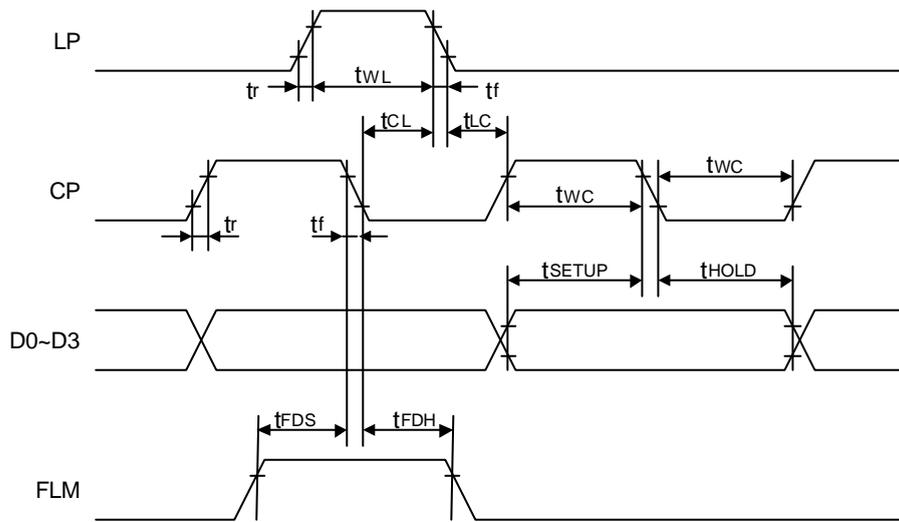


This module contains these capacitors. Please be careful about timing characteristics.

## 2.4. Timing Chart

| | | |
|---|---|---|
| | T=0.0556ms | |

LP

CP

D0 · · · D3 : SEG 313~316 | SEG 317~320 | SEG 1~4 | SEG 5~8 | #1 DATA | SEG 313~316 | SEG 317~320 | SEG 1~4 | SEG 5~8

FLM

LP (Reduction)

240xT

FLM (Reduction)
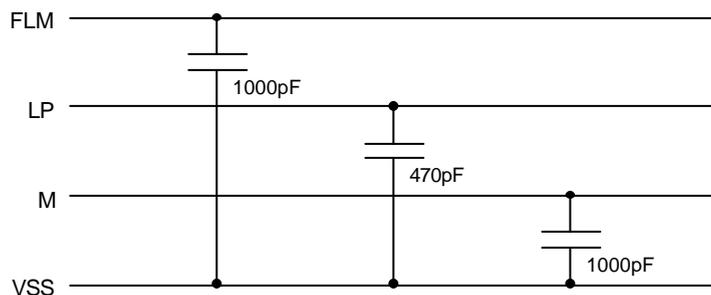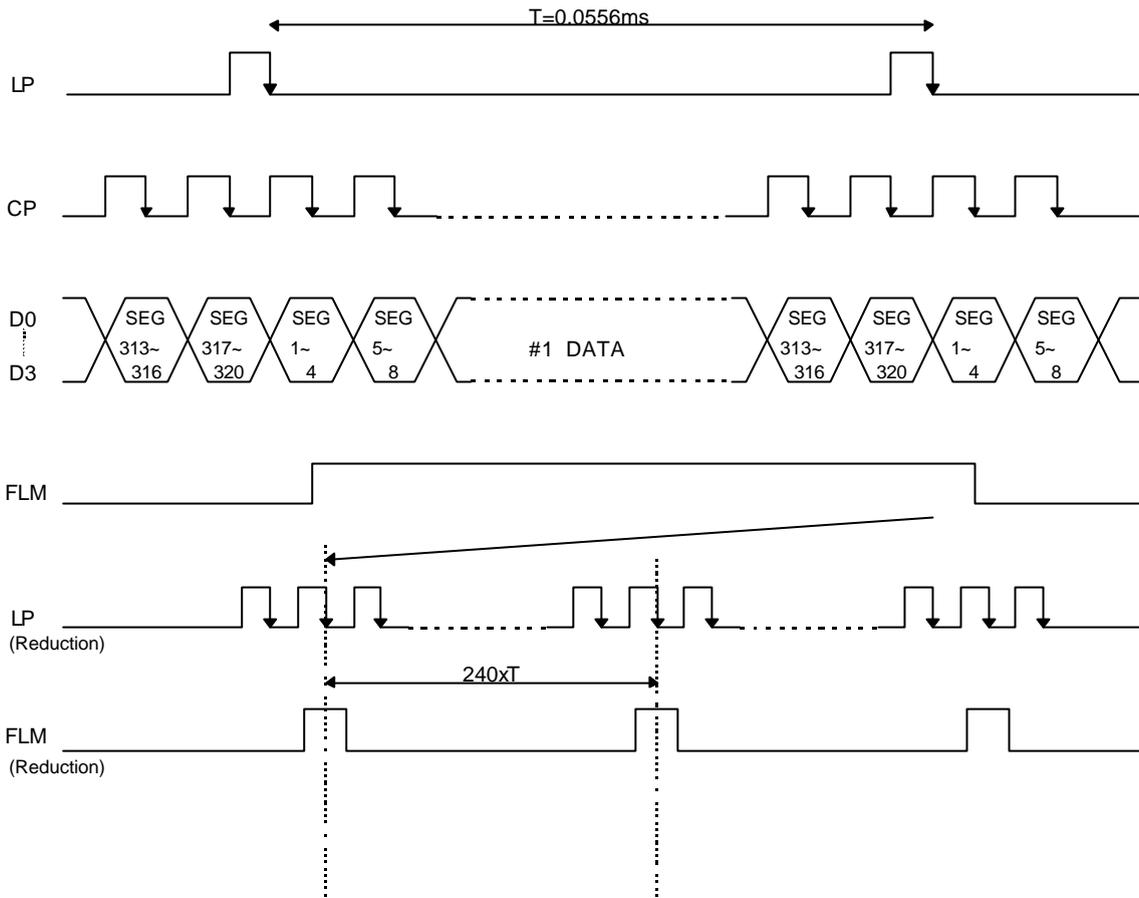
## 2.5. Comparison of Display and Data

SEG1 ......................................................................... SEG320

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| #1 | D3 | D2 | D1 | D0 | ----- ---- ----- | D1 | D0 |

TOP VIEW

D0~D3

#240
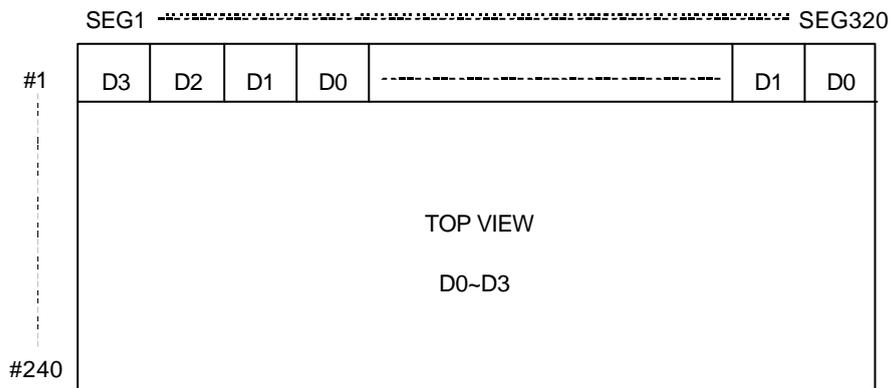
## 2.6. Power Supply ON/OFF Sequence

### 2.6.1. ON Sequence
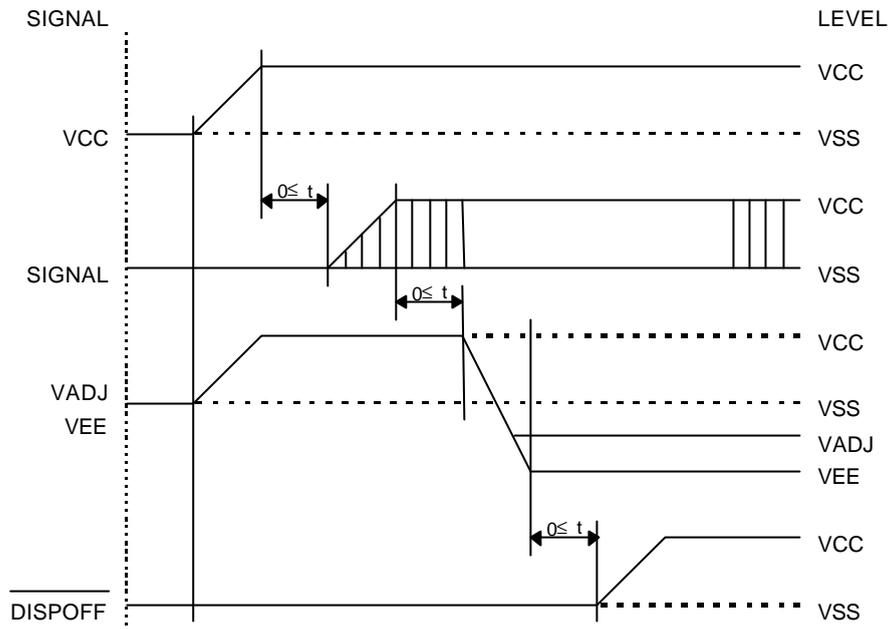


### 2.6.2. OFF Sequence
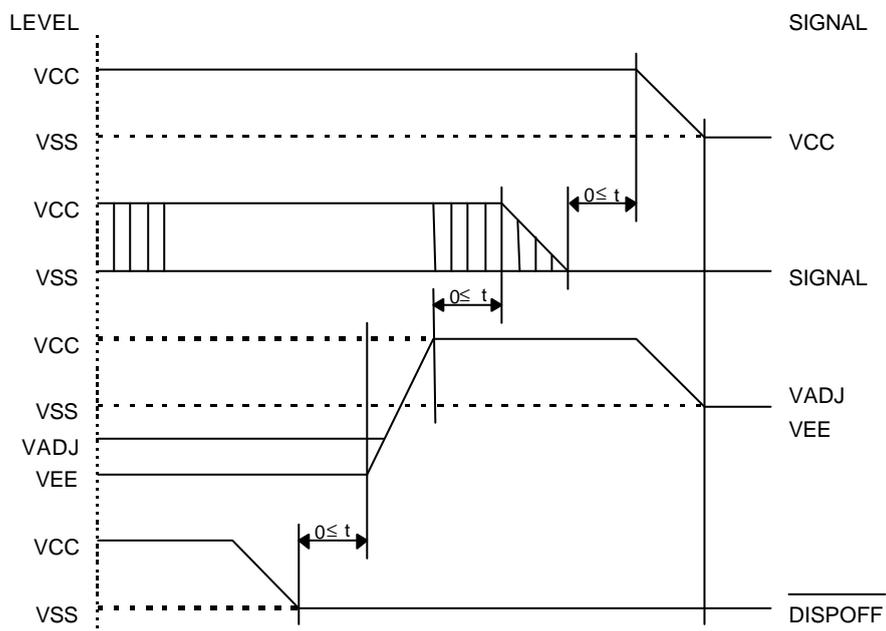


Please maintain the above sequence when turning on and off the power supply of the module.

If DISPOFF is supplied to the module while internal alternate signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

2.7. Lighting Specifications

Ta=25°C

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units | Notes |
|-----------|--------|-----------|------|------|------|-------|-------|
| Lamp Voltage | $V_L$ | - | - | 340 | - | Vrms | 1 |
| Lamp Current | $I_L$ | - | 3.0 | 4.0 | 5.0 | mArms | 2 |
| Starting Voltage | $V_S$ | - | 850 | - | - | Vrms | 3 |
| Surface Luminance | L | $I_L$=4.0mA | - | 60 | - | cd/m$^2$ | 4 |
| Average Life | $T_{AL}$ | $I_L$=4.0mA | 20000 | - | - | hrs | 5 |
| Brightne Ratio | B | $I_L$=4.0mA | 70 | - | - | % | |

Note 1 : The voltage ( r.m.s. ) to maintain the electric discharge of the lamp. It is measured after lighting for 3 minutes .

Note 2 : The current ( r.m.s. ) to flow through the lamp with the electric discharge. It is measured after lighting for 3 minutes.

Note 3 : The voltage at starting the electric discharge when the voltage is increased gradually from 0V.

Note 4 : Surface Luminance is specified by the average of 9 luminance values measured at each point shown above after 20 minutes power on with the all ON pattern adjusted to maximum contrast and the dimming control of 100%. ( maximum brightness )

Note 5 : CFL Life is defined as time period that the actual luminance becomes 50% or lower of its initial value.
The Average life time of CFL is defined as the time when half or more of the testing CFLs have become less bright than 50% of the initial brightness at continuous operation.
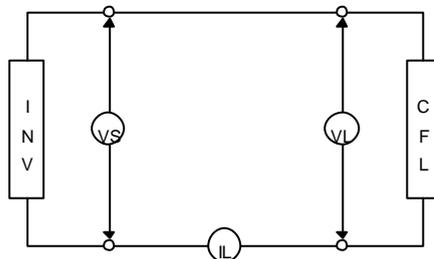
CFL Testing Circuit
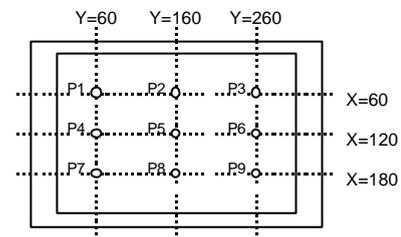
Measurement Points

Recommended Inverter : S-12561 ( Produced by ELEVAM )
CXA-L10L (DC 12.0V, Produced by TDK)

## 3.Optical Specifications

### 3.1.LCD Driving Voltage

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Recommended | | Ta= 0°C | - | - | 26.4 | V |
| LCD Driving Voltage | $V_{CC}-V_{ADJ}$ | Ta=25°C | 21.7 | 23.3 | 24.9 | V |
| Note 1 | | Ta=60°C | 20.0 | - | - | 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

Ta=25°C, 1/240 Duty, 1/14 Bias, $V_{OD}$=22.7V (Note 4), θ= 0°C, φ=-°

| Parameter | | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Contrast Ratio      Note 1 | | CR | θ= 0°C , φ=-° | - | 5 | - | |
| Viewing Angle | | | Shown in 3.3 | | | | |
| Response | Rise   Note 2 | $T_{ON}$ | - | - | 250 | 380 | ms |
| Time | Decay Note 3 | $T_{OFF}$ | - | - | 280 | 420 | ms |

Note 1 :Contrast ratio is definded as follows. (CR = $L_{ON}$ / $L_{OFF}$)

   $L_{ON}$ : 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 $V_{OD}$

   $V_{OD}=V_{CC}-V_{ADJ}-V_{BE}$

   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
   $V_{OD}$ is definded as the voltage $V_{O-P}$ when the contrast ratio (CR=$L_{ON}$ / $L_{OFF}$) is at its
   maximum.



( ON SIGNAL )                    ( OFF SIGNAL )
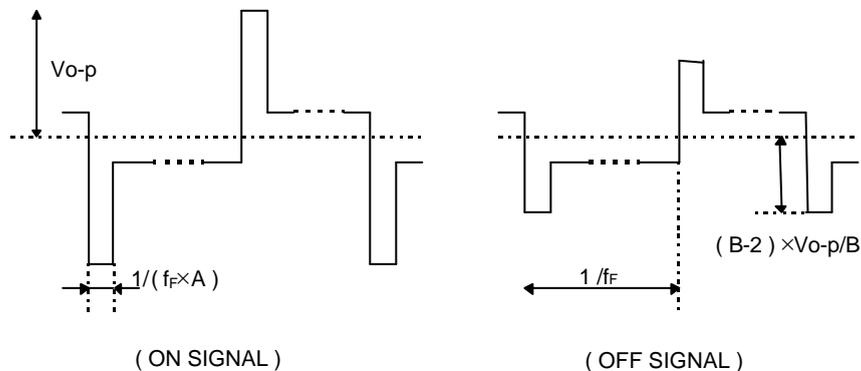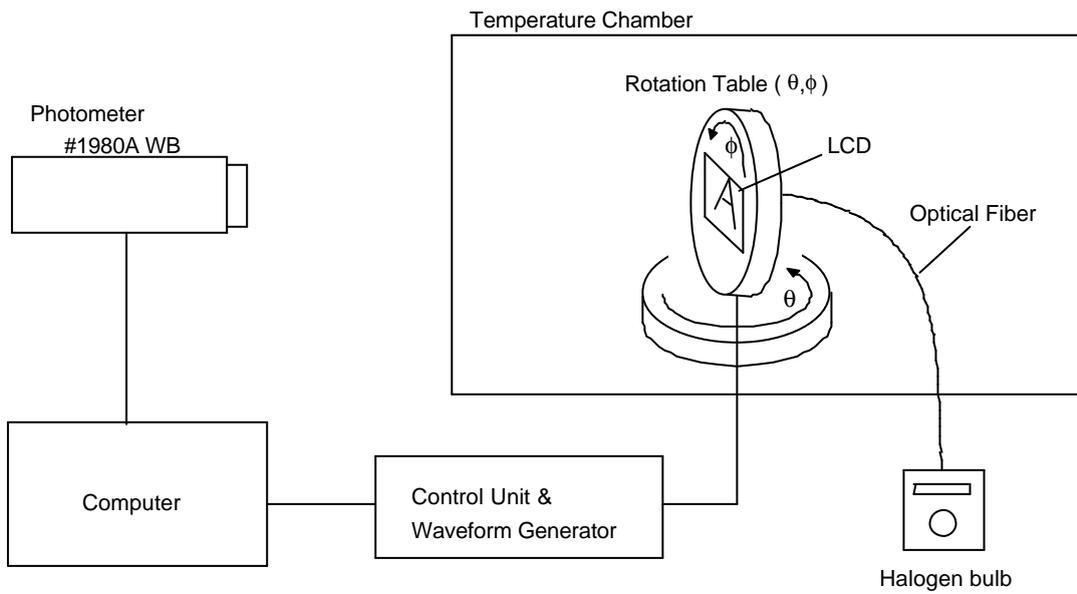
### 3.3. Definition of Viewing Angle and Optimum Viewing Area

*Point • shows the point where contrast ratio is measured. : $\theta= 0°$, $\phi= -°$
*Driving condition : 1/240 Duty, 1/14 Bias, $V_{OD}$=22.7V, $f_F$=75Hz
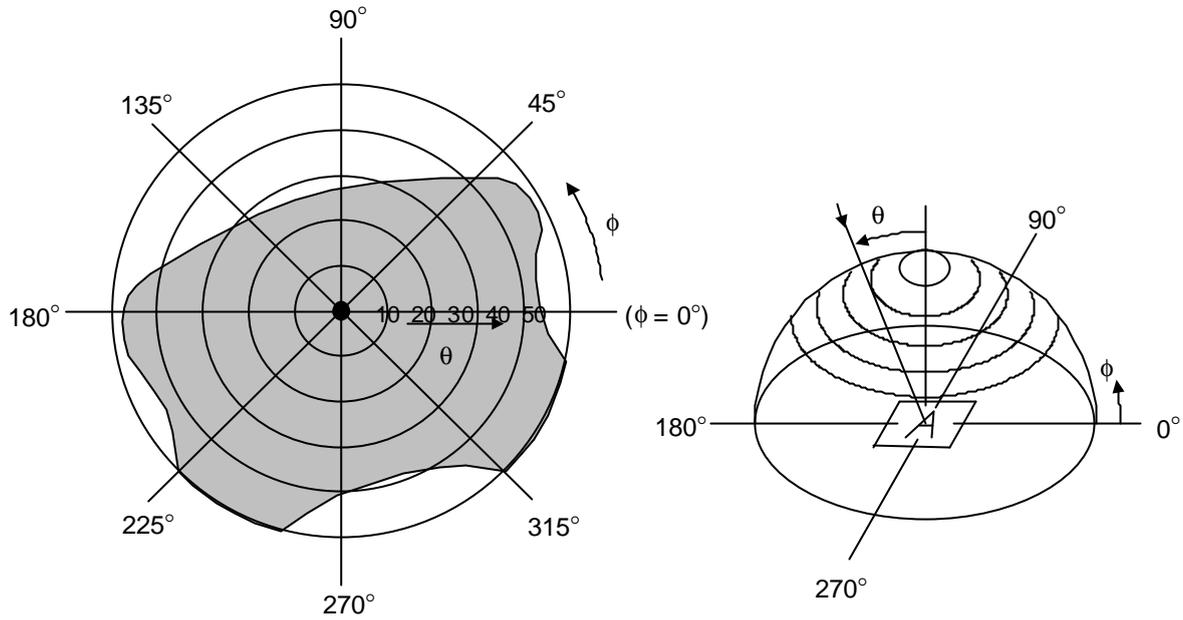


*Area ▢ shows typ. CR≥2

### 3.4. System Block Diagram

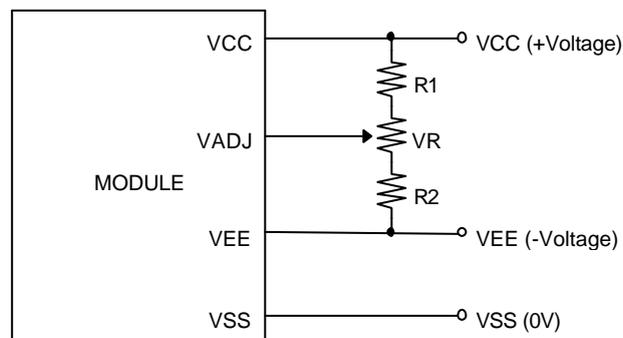## 4.I/O Terminal

### 4.1. Pin Assignment

CN1

| No. | Symbol | Level | Function |
|-----|--------|-------|----------|
| 1 | D0 | H / L | Display Data |
| 2 | D1 | H / L | Display Data |
| 3 | D2 | H / L | Display Data |
| 4 | D3 | H / L | Display Data |
| 5 | $\overline{\text{DISPOFF}}$ | H / L | H : Display on  L : Display off (Pull up Resister) |
| 6 | FLM | H / L | First Line Marker |
| 7 | NC | - | Non-connection |
| 8 | LP | H→L | Data Latch Signal |
| 9 | CP | H→L | Clock Signal for Shifting Data |
| 10 | $V_{CC}$ | - | Power Supply for Logic |
| 11 | $V_{SS}$ | - | Power Supply (0V, GND) |
| 12 | $V_{EE}$ | - | Power Supply for LCD Drive |
| 13 | $V_{ADJ}$ | - | Voltage Level for LCD Contrast Adjustment |
| 14 | FG | - | Frame Ground |

CN2

| No. | Symbol | Level | Function |
|-----|--------|-------|----------|
| 1 | CFL HOT | - | Power Supply for CFL (HOT) |
| 2 | NC | - | Non-connection |
| 3 | NC | - | Non-connection |
| 4 | CFL GND | - | Power Supply for CFL (GND) |

### 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~ 20KΩ

## 4.3. Block Diagram

```
FLM ──────────●────────→ ┌─────────────┐      240      ┌─────────────┐
              │          │  Row Driver  ├──────/──────→ │    L C D P   │
              │          │ LC79430D × 3 │               │              │
              │          │ or equivalent│               │ 320 × 240 dots│
              │          └──────┬───┬───┘               └──────┬───────┘
 ___          │            2    │   │                          │
 LP ──────────●───────/─────────┘   │                    320   │
DISPOFF       │      2             │         ┌─────/───────────┘
              ●─────/──────────────┼───────→ ┌─────────────┐
              │                    │         │Column Driver │
 CP ──────────┼────────────────────┼───────→ │ LC79401D × 4 │
              │                    │         │ or equivalent│
              │              4     │         └───┬───┬──────┘
D0~D3 ────────┼───────/────────────┼──────────┘  │   │
              │   LP  ┌────────────┴──┐          │   │
              └──────→│   M Circuit    ├──●───────┘   │
                      └────────────────┘  └───────────┘
```

```
VCC ─────────────────────────┐
                             │
VSS ──────────┐        ┌─────┴──────────┐
             ═╧═       │  Bias Circuit   ├──────→ To LSI
                      │                 │
VADJ ─────────────────┤                 │
                      │                 │
VEE ──────────────────┴─────────────────┘
```

```
CFL HOT ──────────┌──────────────────┐
                  │  CFL Backlight    ├──┐
CFL GND ──────────┴──────────────────┘  │
```
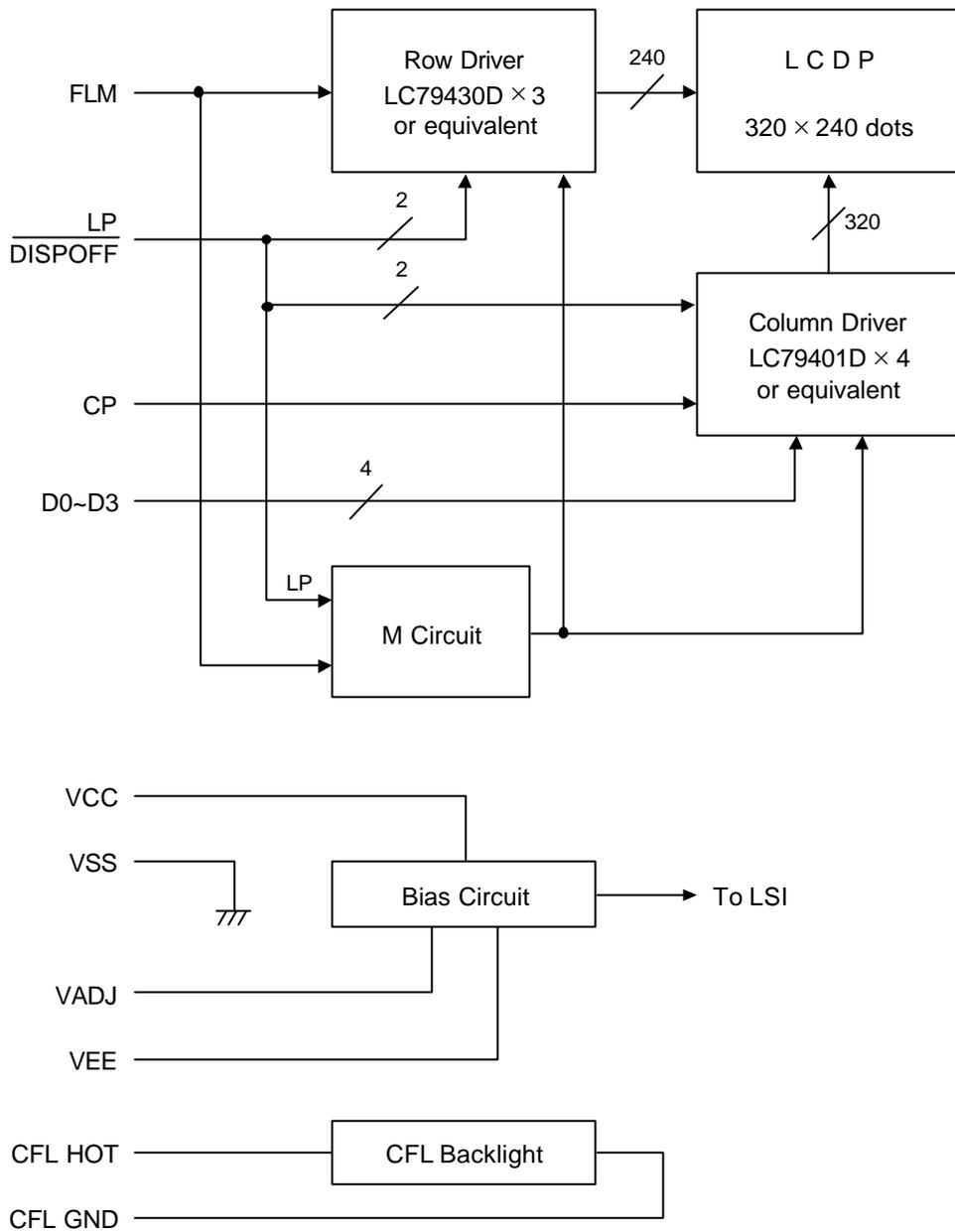
## 5. Test

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

Conditions: Unless otherwise specified, tests will be conducted under the following condition.
Temperature: 20±5°C
Humidity : 65±5%RH
tests will be not conducted under functioning state.

| No. | Parameter | Conditions | Notes |
|---|---|---|---|
| 1 | High Temperature Operating | 60°C±2°C, 96hrs (operation state) | |
| 2 | Low Temperature Operating | 0°C±2°C, 96hrs (operation state) | 1 |
| 3 | High Temperature Storage | 60°C±2°C, 96hrs | 2 |
| 4 | Low Temperature Storage | -20°C±2°C, 96hrs | 1,2 |
| 5 | Damp Proof Test | 40°C±2°C,90~95%RH, 96hrs | 1,2 |
| 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 | 3 |
| 7 | Shock Test | To be measured after dropping from 60cm high on the concrete surface in packing state.<br><br>Dropping method corner dropping<br>A corner : once<br>Edge dropping<br>B,C,D edge : once<br>Face dropping<br>E,F,G face : once | |
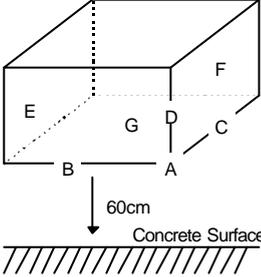
Note 1 :No dew condensation to be observed.
Note 2 :The function test shall be conducted after 4 hours storage at the normal
Temperature and humidity after removed from the test chamber.
Note 3 :Vibration test will be conducted to the product itself without putting it in a container.

## 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.
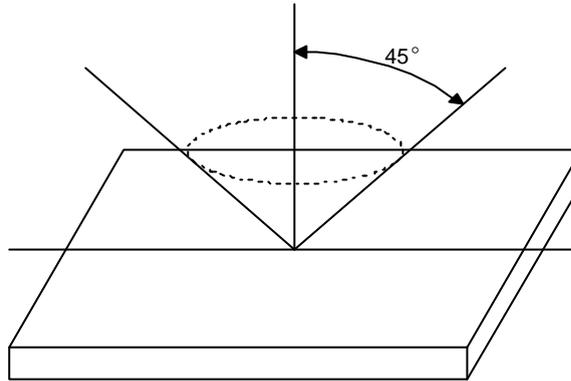


### 6.2.Definition of applicable Zones



X=122.0mm
Y=90.0mm
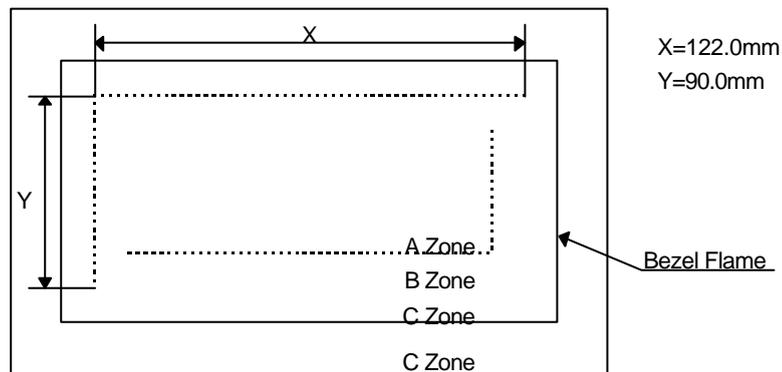
A Zone : Active display area

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

C Zone : Rest parts

A Zone + B Zone = Validity viewing area

6.3. Standards

| No. | Parameter | Criteria |
|---|---|---|
| 1 | Black and White Spots, Foreign Substances | (1) Round Shape |

| Zone / Dimension (mm) | A | B | C |
|---|---|---|---|
| D ≤0.1 | * | * | * |
| 0.1 < D ≤0.2 | 3 | 5 | * |
| 0.2 < D ≤0.25 | 2 | 3 | * |
| 0.25< D ≤0.3 | 0 | 1 | * |
| 0.3 < D | 0 | 0 | * |

D = ( Long + Short ) / 2    * : Disregard

(2) Line Shape

| X (mm) | Y (mm) | 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) | | |

X : Length  Y : Width    * : Disregard

Total defects shall not exceed 5.

| No. | Parameter | Criteria |
|---|---|---|
| 2 | Air Bubbles (between glass & polarizer) | |

| Zone / Dimension (mm) | A | B | C |
|---|---|---|---|
| D ≤0.3 | * | * | * |
| 0.3 < D ≤0.4 | 3 | * | * |
| 0.4 < D ≤0.6 | 2 | 3 | * |
| 0.6 < D | 0 | 0 | * |

* : Disregard

Total defects shall not exceed 3.

| No. | Parameter | Criteria |
|---|---|---|
| 3 | The Shape of Dot | (1) Dot Shape (with Dent)<br><br>$0.15 \geq$<br><br>As per the sketch of left hand.<br><br>(2) Dot Shape (with Projection)<br><br>Should not be connected to next dot.<br><br>(3) Pin Hole<br><br>X<br><br>$(X+Y) / 2 \leq 0.2mm$<br>(Less than 0.1mm is no counted.)<br><br>(4) Deformation<br><br>Y<br><br>$(X+Y) / 2 \leq 0.2mm$<br><br>X<br><br>Total acceptable number : 1/dot, 5/cell<br>(Defect number of (4) : 1pc.) |
| 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 substances 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 |
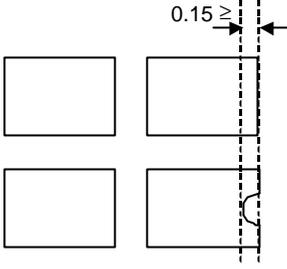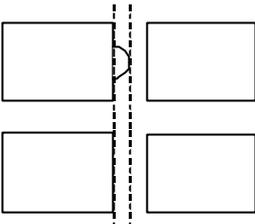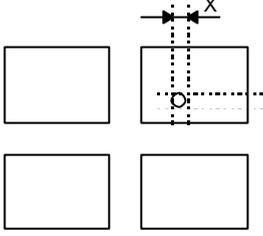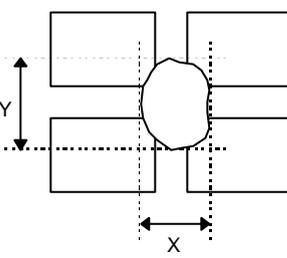
## 7.Code System of Production Lot

The production lot of module is specified as follows.

☐☐ ☐ ☐ ☐ ☐ — ☐ ☐☐

— Factory Control Number (0~99)
— Date of the week (A~G)
— Factory Number (0~9)
— Factory Code (Alphabet)
— Production Week (1~5)
— Production Month (1~9, X, Y, Z)
— Production Year (Lower 2 digits)
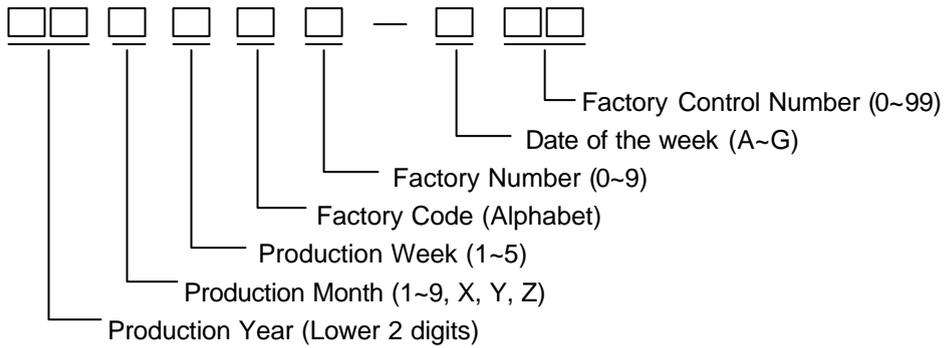
## 8.Type Number

The type number of module is specified as follows.

DMF-50840NB-FW-ASE-BFN

## 9.Applying Precautions

Please contact us when questions and/or new problems not specified in this
Specifications arise.

## 10.Precautions Relating Product Handling

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

1) Liquid crystal display devices
   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.
   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.
   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. Avoid the use of work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
   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:
   1. Protect the modules from high temperature and humidity.
   2. Keep the modules out of direct sunlight or direct exposure to ultraviolet rays.
   3. Protect the modules from excessive external forces.

4) Use the module with a power supply that is equipped with an overcurrent 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.

7) For models which use CFL:
   1. High voltage of 1000V or greater is applied to the CFL cable connector area. Care should be taken not to touch connection areas to avoid burns.
   2. Protect CFL cables from rubbing against the unit and thus causing the wire jacket to become worn.
   3. The use of CFLs for extended periods of time at low temperatures will significantly shorten their service life.

8) For models which use touch panels:
   1. Do not stack up modules since they can be damaged by components on neighboring modules.
   2. Do not place heavy objects on top of the product. This could cause glass breakage.

9) For models which use COG,TAB,or COF:
   1. The mechanical strength of the product is low since the IC chip faces out unprotected from the rear. Be sure to protect the rear of the IC chip from external forces.
   2. Given the fact that the rear of the IC chip is left exposed, in order to protect the unit from electrical damage, avoid installation configurations in which the rear of the IC chip runs the risk of making any electrical contact.

10) Models which use flexible cable, heat seal, or TAB:
  1. In order to maintain reliability, do not touch or hold by the connector area.
  2. Avoid any bending, pulling, or other excessive force, which can result in broken connections.

11) In case of buffer material such as cushion / gasket is assembled into LCD module, it may have an adverse effect on connecting parts ( LCD panel-TCP / HEAT SEAL / FPC / etc., PCB-TCP / HEAT SEAL / FPC etc., TCP-HEAT SEAL, TCP-FPC, HEAT SEAL-FPC, etc.,) depending on its materials.
    Please check and evaluate these materials carefully before use.

12) In case of acrylic plate is attached to front side of LCD panel, cloudiness ( very small cracks ) can occur on acrylic plate, being influenced by some components generated from polarizer film..
    Please check and evaluate those acrylic materials carefully before use.


## 11.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. When the product is in CFL models, CFL service life and brightness will vary According to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.

  5. We cannot accept responsibility for intellectual property of a third party, which may arise through the application of our product to your assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.

  6. Optrex will not be held responsible for any quality guarantee issue for defect products judged as Optrex-origin longer than 2 (two) years from Optrex production or 1(one) year from Optrex, Optrex America, Optrex Europe delivery which ever comes later.