# K3247H-FL

# Liquid Crystal Display

# Product Specification

*Transmissive colour display*

*Quarter-VGA resolution: 320 x 240 dots*

*2.8 inch screen size*

*LED backlight*

*High contrast ratio*

*Compact size and thickness*

**Citizen Systems Europe**

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CSE Release date: January 2002

This specification is subject to change without notice.
Please contact Citizen or it's representative before designing your product based on this specification.

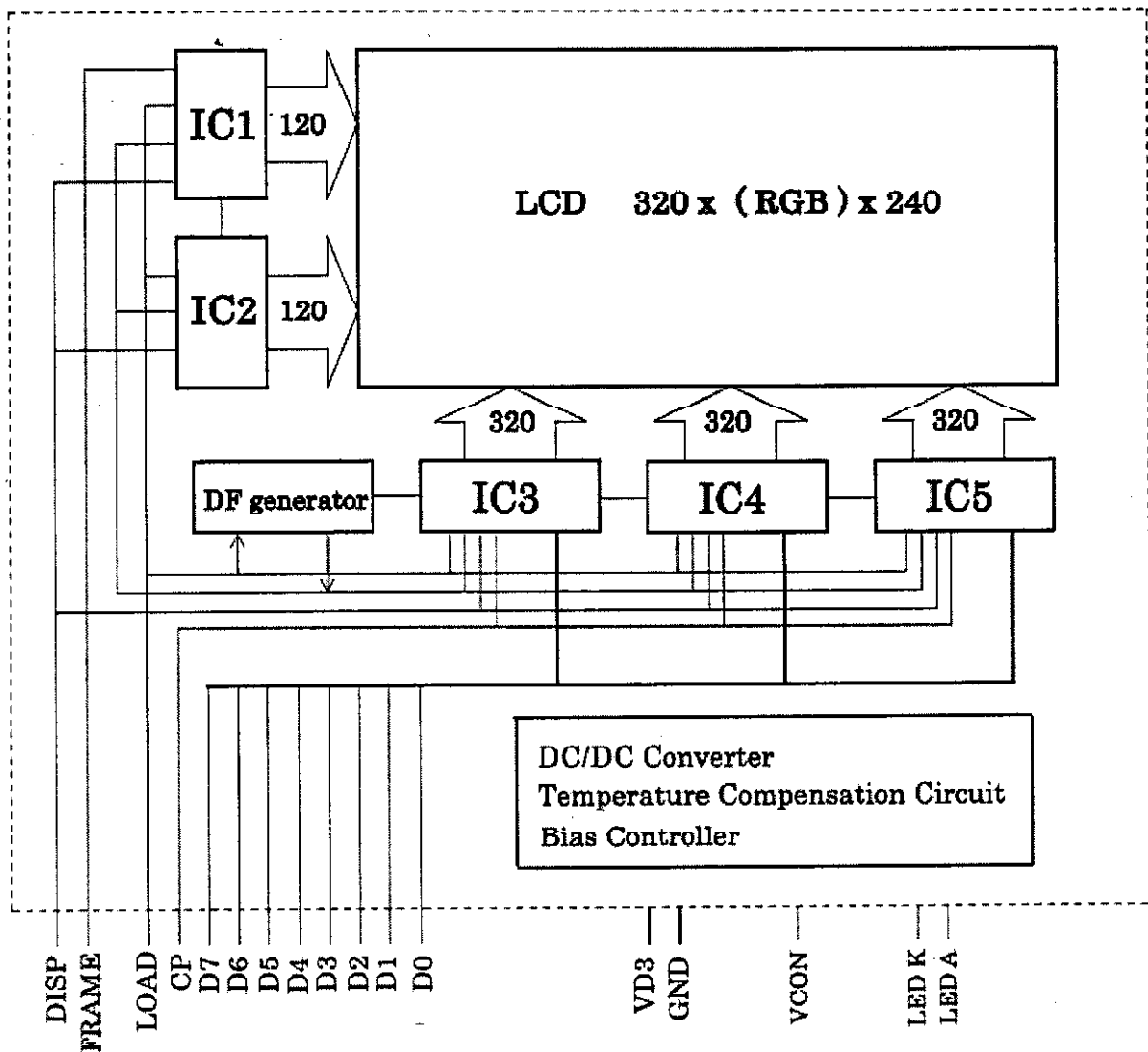Record of Revision

| Revision No. | Summary | Date | Person |
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1. Application

   This specification shall be applied to Dot Matrix LCD Module K3247H-FL.

2. Composition

   Display Type:      Color STN Transmissive type
   Dot Structure:     320 x RGB x 240 Dots graphics display
   Driving Method:    1/240(min.) Duty Multiplex drive
   Back Light:        LED
   Surface Texture:   Glare

Block Diagram



Notes: K3247H-FL doesn't incorporate any controller.

Fig. 2-1

## 3. Mechanical Specifications

### 3-1 Dimensions and weights

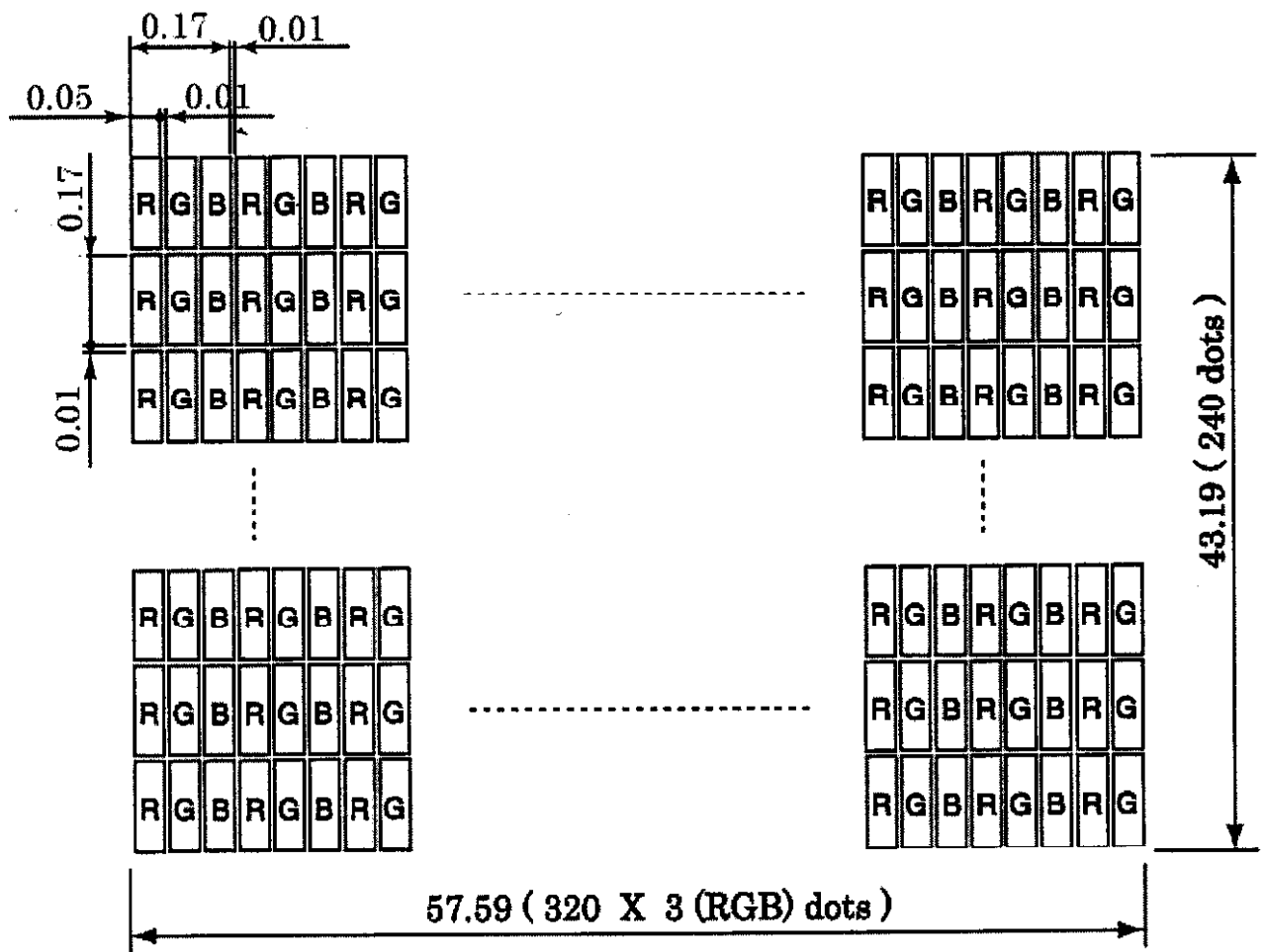| Item | Dimensions | Unit |
|---|---|---|
| Module size | 71.3 (W) × 57.8(H) × 7.04 (D)　max　(Note1) | mm |
| Viewing area | 59.5　(W)　×　45　(H) | mm |
| Weight | TBD | g |

Note1: except for wires of CN2.

### 3-2. ドット寸法図

(Unit: mm)



Fig 3-1

## 4. Absolute maximum ratings

### 4-1 Electrical Absolute maximum ratings

(GND=0V)

| Item | Symbol | Min | Max | Unit | Remarks |
|---|---|---|---|---|---|
| Supply Voltage | VD3 | −0.3 | +4.5 | V | Note 1 |
| Signal Voltage | VIN | −0.3 | VD3+0.3 | V | Note 2 |
| Contrast Control Voltage | VCON | −0.3 | VD3+0.3 | V | |

Note 1: If the LSI is used beyond the above maximum ratings, it may be permanently damaged. It should always be used within its specified operating range fornormal operation to prevent malfunction or degraded reliability.

Note 2 : DISP ,FRAME ,DF ,LOAD ,CP ,D7~0

### 4-2 Environmental absolute maximum ratings

| Item | Specification | Remarks |
|---|---|---|
| Storage temperature | Max +70 ℃ Min -20 ℃ | Note 1 No Condensation |
| Operating temperature | Max +50 ℃ Min -10 ℃ | Note 1 No Condensation |

Note 1: Ta≦+40℃ ‥ 90% RH Max.

Ta＞+40℃ ‥ Absolute humidity must be lower than humidity of 90%RH at +40℃

5. Electrical Specification

5-1. Electrical Characteristics

( GND = 0V , 25 ℃ )

| Item | | Symbol | Condition | Min | Typical | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Supply Voltage | | VD3 | | 3.1 | 3.3 | 3.5 | V | |
| Input signal voltage | H level | VSH | | 0.9VD3 | - | VD3 | V | Note 1 |
| | L level | VSL | | 0 | - | 0.1VD3 | V | |
| Frame frequency | | fFRAME | | - | 70 | - | Hz | |
| Current Consumption | | ID3 | Ta=25 ℃<br>VD3=3.3V<br>fFRAME=70Hz<br>DF−13 Lines<br>Duty=1/241<br>CRmax | - | 1.8<br>(TBD) | 2.8<br>TBD | mA | Note 2 |

Note 1:　DISP, FRAME, DF, LOAD, CP, D7∼0
Note 2:　Display patterns of current consumption are as follows.

　　　　ID3 ‥　Typical value：　Display of character "A" of 40 rows × 24 lines on whole screen.
　　　　　　　　Max value：　Display of hatching of 8 dots horizontally × 1 dot vertically.

5-2 Contrast adjustment ( VCON )

　　The contrast of LCD differs depending on the charges in visual angle, ambient temperature, and supply voltage. So, make adjustment by operating VCON voltage.

　　If the VCON voltage value decreases, the LCD display becomes light.
　　If the VCON voltage value increases, the LCD display becomes dark.

　　Note) Center voltage of VCON is set to 1.6 V at our factory.

5-3. Power Circuit
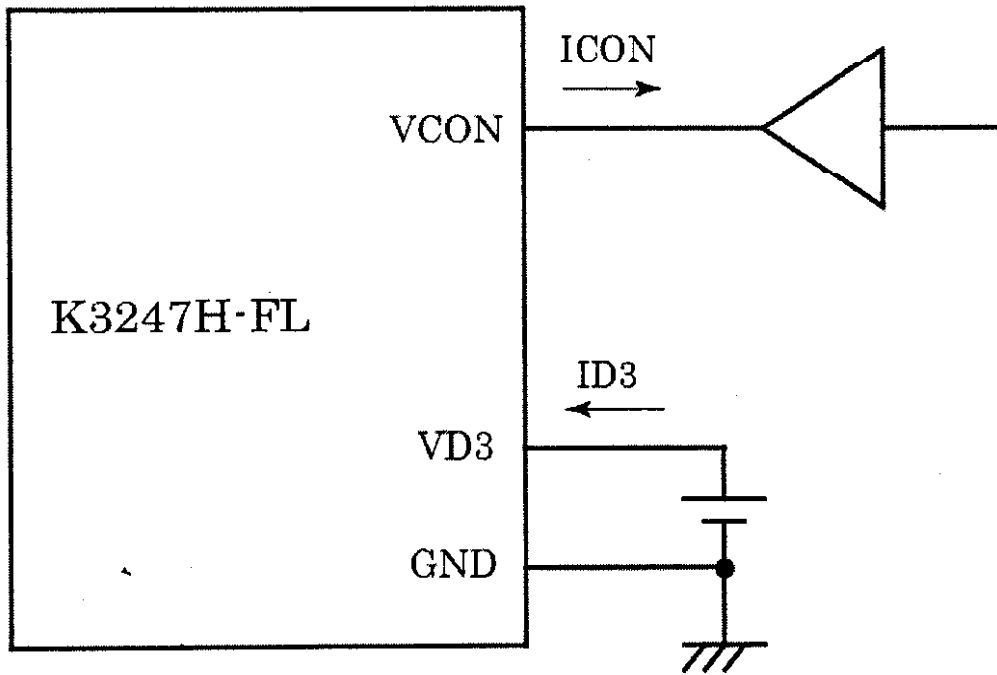


Fig. 5-1

5-4. Power Sequence
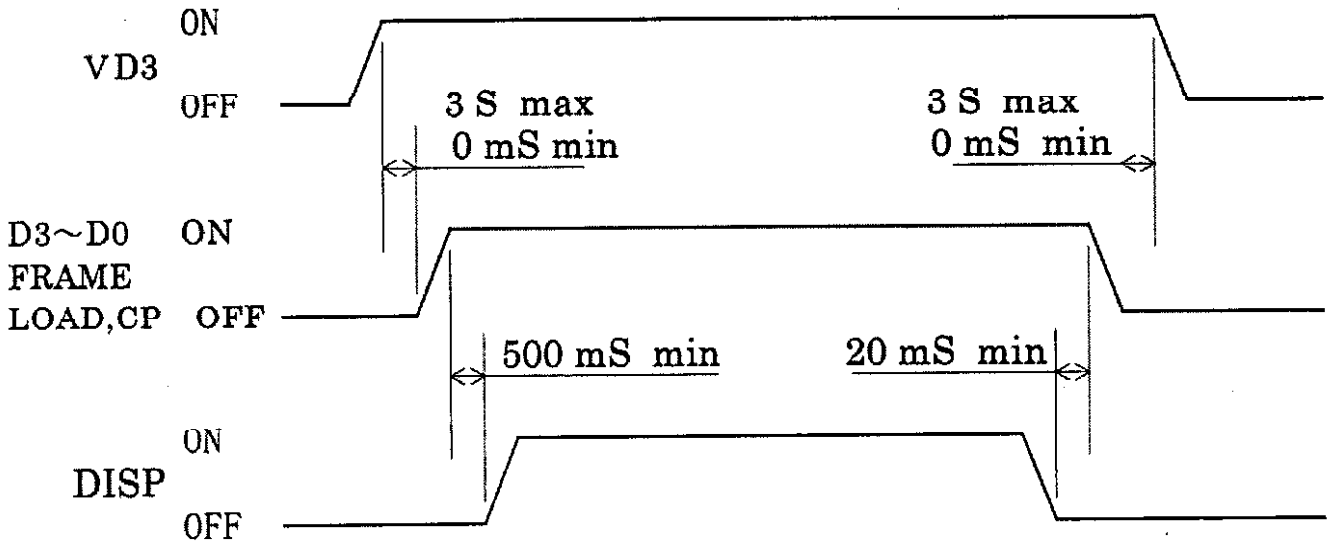


Fig. 5-2

| Date | 07th DEC. 2001 | LCD Device Division | Spec. No. | PRELIMINARY |
|---|---|---|---|---|
| | | | Remarks | |

6. Interface specifications

6·1 Terminal pin assignment of CN1

| No. | Name | I/O | Function |
|---|---|---|---|
| 1 | VD3 | IN | Power Supply for Logic Circuit   (3.3V) |
| 2 | GND | IN | GND |
| 3 | DISP | IN | Display control signal        VD3 level      :    Normal<br>GND level      :    Display off |
| 4 | FRAME | IN | LCD COM electrode scanning data |
| 5 | NC | - | No connection |
| 6 | LOAD | IN | LCD SEG electrode driving voltage output clock.<br>LCD COM electrode scanning data shift clock. |
| 7 | CP | IN | Display data input clock. |
| 8 | D0 | IN | Display data |
| 9 | D1 | IN | Display data |
| 10 | D2 | IN | Display data |
| 11 | D3 | IN | Display data |
| 12 | D4 | IN | Display data |
| 13 | D5 | IN | Display data |
| 14 | D6 | IN | Display data |
| 15 | D7 | IN | Display data |
| 16 | VCON | OUT | Contrast adjustment voltage. |
| 17 | NC | - | No connection |
| 18 | NC | - | No connection |
| 19 | LED K | IN | Power supply for LED, - voltage. |
| 20 | LED A | IN | Power supply for LED, + voltage. |

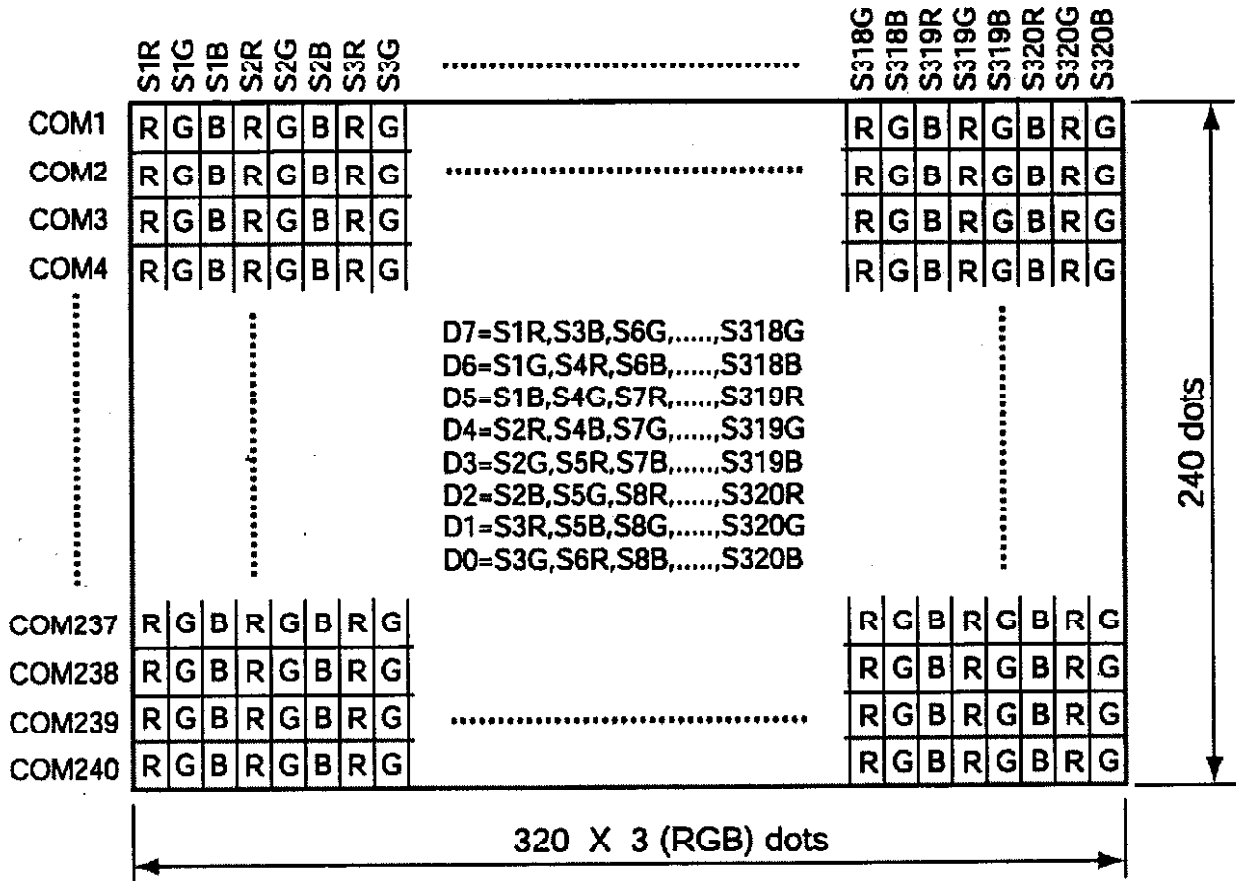6-2 Relationships of DATA input signal and LCD Screen division.



D7=S1R,S3B,S6G,......,S318G
D6=S1G,S4R,S6B,......,S318B
D5=S1B,S4G,S7R,......,S319R
D4=S2R,S4B,S7G,......,S319G
D3=S2G,S5R,S7B,......,S319B
D2=S2B,S5G,S8R,......,S320R
D1=S3R,S5B,S8G,......,S320G
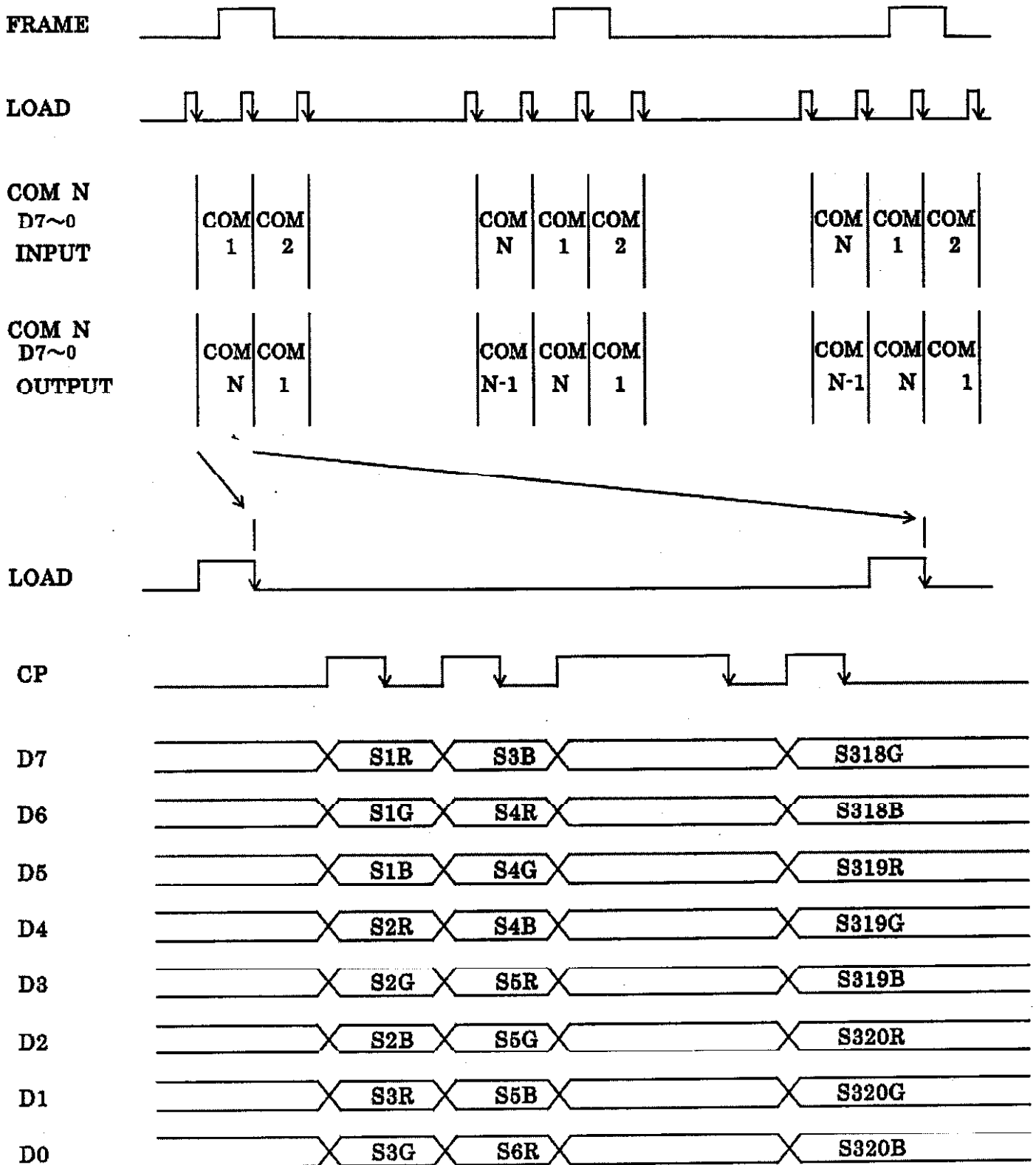D0=S3G,S6R,S8B,......,S320B

320 X 3 (RGB) dots

Fig. 6-1

6-3. Timing diagram ( 1 / N Duty )



Fig. 6-2

Note: LOAD signal should be inputted with constant interval.
Please contact us for more detail information.

| Date | 07th DEC. 2001 | LCD Device Division | Spec. No. | PRELIMINARY |
| --- | --- | --- | --- | --- |
| | | | Remarks | |

6-4 Switching characteristics

VD3-GND = 3.3V±0.1V、 VCC-VSS=3.3V±0.1V

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| CP cycle time | tcp | | 170 | — | — | ns |
| CP pulse width | tW(CH) | | 70 | — | — | ns |
| | tW(CL) | | 70 | — | — | ns |
| LOAD pulse width | tW(LH) | | 500 | — | — | ns |
| | tW(LL) | | 10 | — | — | $\mu$s |
| LOAD to CP time | tLC | | 120 | — | — | ns |
| CP to LOAD time | tCL | | 120 | — | — | ns |
| Data setup time D3~D0 to CP | tDSU | | 55 | — | — | ns |
| Data hold time CP to D3~D0 | tDHD | | 55 | — | — | ns |
| LOAD to FRAME time | tLF | | 500 | — | — | ns |
| FRAME to LOAD time | tFL | | 500 | — | — | ns |
| FRAME setup time FRAME to LOAD | tSU(FR) | | 500 | — | — | ns |
| FRAME hold time LOAD to FRAME | tHD(FR) | | 500 | — | — | ns |
| CP rise time | tR(CP) | | — | — | 20 | ns |
| Cp fall time | tF(CP) | | — | — | 20 | ns |
| LOAD rise time | tR(L) | | — | — | 20 | ns |
| LOAD fall time | tF(L) | | — | — | 20 | ns |

Note: LOAD signal should be inputted with constant interval.

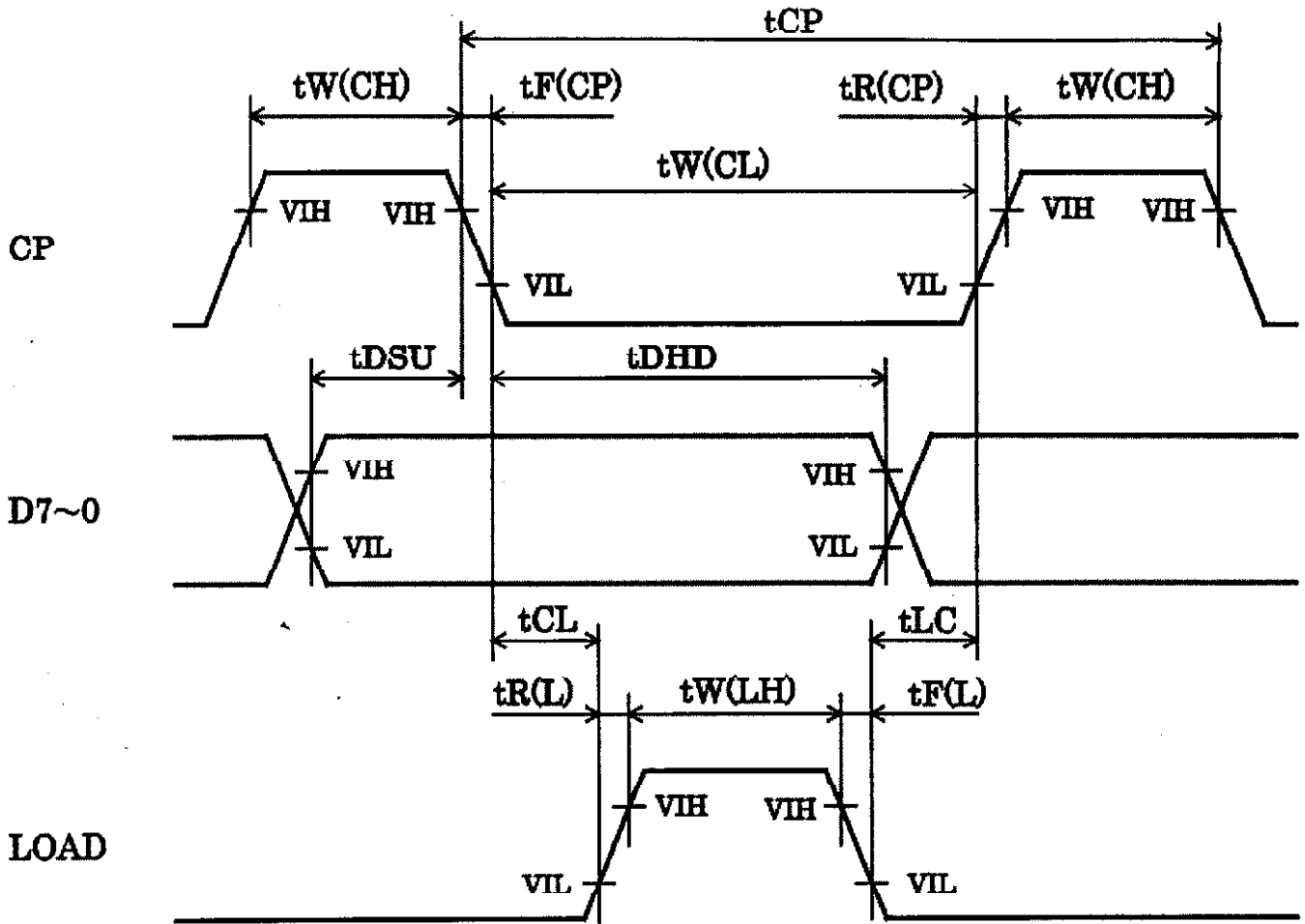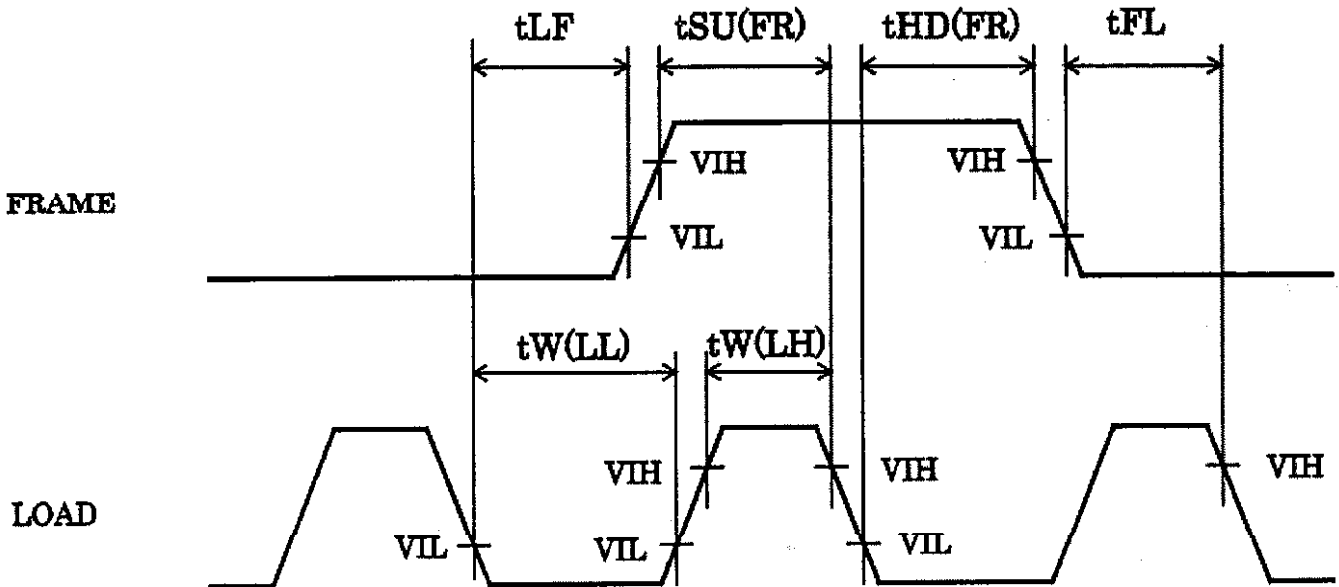| Date | 07th DEC. 2001 | LCD Device Division | Spec. No. | PRELIMINARY |
|---|---|---|---|---|
| | | | Remarks | |

Fig. 6-3

Fig. 6-4

7. Optical Characteristics. Refer to Note 1 to 5

LCD Driving condition:　　Ta=25℃ , VD3=3.3V , VD2=3.0V , VM=1.5V , GND=0V

Contrast max. , FRAME=70Hz , DF=13Lines , Duty=1/241

LED Driving condition:　　LED current=60 mA

### 7-1 Optical characteristics (1)

| Item | | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|---|
| Response Time(TBD) | | tON | - | 370 | 555 | mS | $\theta$=0 , $\phi$=0 |
| | | tOFF | - | 220 | 330 | mS | |
| Contrast Ratio | | CR | - | 18 (TBD) | - | - | $\theta$=0 , $\phi$=0 |
| Visual Angle | Vertical | $\theta$1 | -35 $\leqq$ $\theta$1$\leqq$ +40 (TBD) | | | deg | $\phi$=0, CR$\geqq$1.5 |
| | Horizontal | $\theta$2 | -35 $\leqq$ $\theta$2$\leqq$ +35 (TBD) | | | deg | $\phi$=90, CR$\geqq$1.5 |
| Visual Field Enlarging Direction | | — | 6:00 | | | | |

### 7-2 Optical characteristics (2)

CIE 1931 standard colorimetric system

| Item | Symbol | Typical value | Condition |
|---|---|---|---|
| White | x | (TBD) | $\theta$=0° , $\phi$=0° |
| | y | (TBD) | |
| Red | x | (TBD) | $\theta$=0° , $\phi$=0° |
| | y | (TBD) | |
| Green | x | (TBD) | $\theta$=0° , $\phi$=0° |
| | y | (TBD) | |
| Blue | x | (TBD) | $\theta$=0° , $\phi$=0° |
| | y | (TBD) | |

<Note1>　K3244H-FF Driving conditions　VD3 = 3.3V

FRAME = 70H z

Duty = 1/241 ,DF=13 Lines (Alternative LCD Driving voltage period)

Display Pattern : all screen On and OFF

Adjusted to Contrast maximum

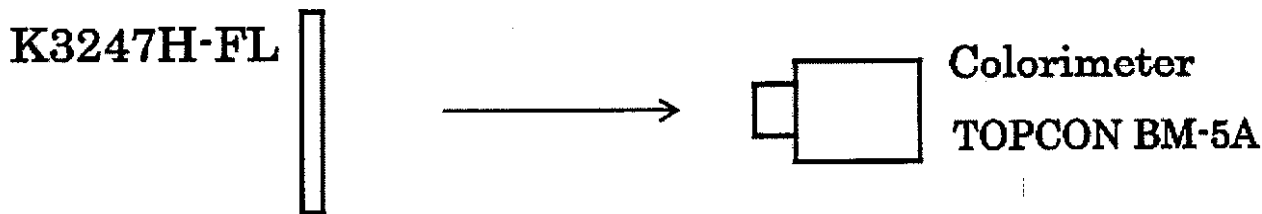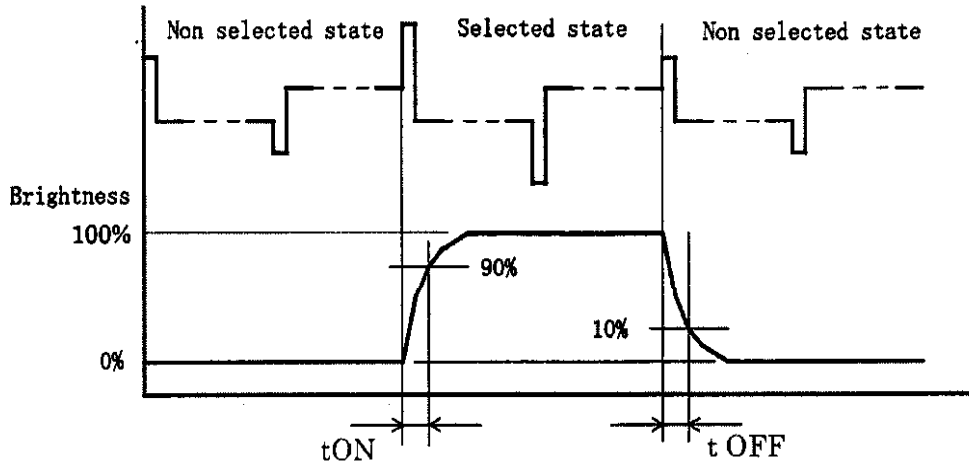<Note2>　Optical Characteristics measurement system

**K3247H-FL** 　　　　　　　　　　　　→　　　　**Colorimeter**

**TOPCON BM-5A**

Fig. 7-1

<Note3>  Definition of response time



Fig. 7-2

<Note 3>  Definition of $\phi$ and $\theta$
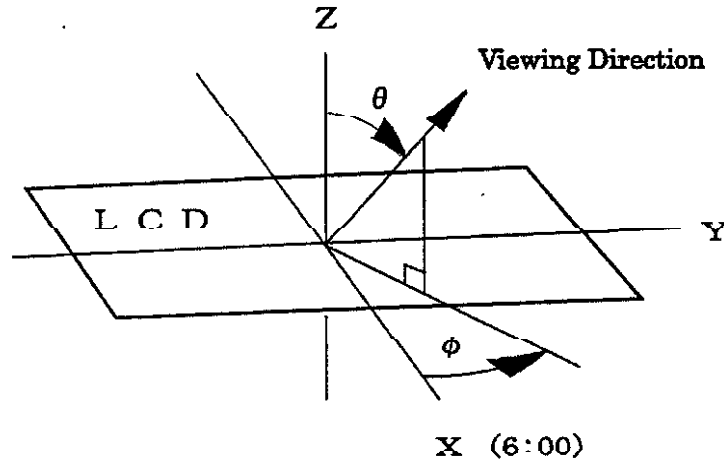


Fig. 7-3

<Note 4>  Definition of Contrast

$$CR= \frac{\text{Selected state Brightness}(B\,s)}{\text{Non selected state Brightness}(B\,ns)}$$
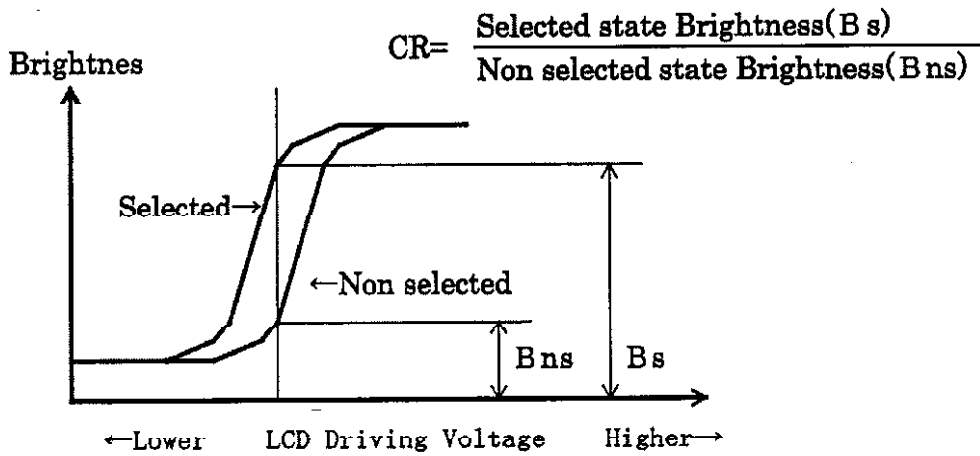


Fig. 7-4

| Date | 07th DEC. 2001 | LCD Device Division | Spec. No. | PRELIMINARY |
|---|---|---|---|---|
| | | | Remarks | |

\<Note.5\> Definition of visual field enlarging direction
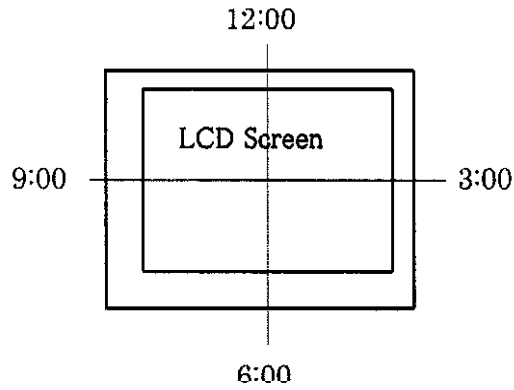
12:00

LCD Screen

9:00            3:00

6:00

Fig. 7-5

8. Precautions in use

## 8-1 Handling

(1) The polarizer is quite susceptible to scratches. Handle it very carefully. Do not handle it with metal tweezers, nor press nor rub it.

(2) Do not contact the display surface by hand nor get it stained. If the surface is dirty, wipe it off lightly with a cotton swab or a piece of soft cloth or chamois, which is soaked with petroleum or benzene. Never use organic solvents including acetone, toluene, ethanol, and isopropyl alcohol: they would damage the surface.

(3) Do not allow saliva or water to remain on the surface for long; it might cause a local deformation or discoloration.

(4) When the LCD has broken and the liquid crystal has come out, never allow it in your mouth. If it sticks to the skin or clothes, wash it off immediately by using soap.

## 8-2 Setting

(1) The ICs mounted on the PCB are very susceptible to static electricity. To protect them from static electricity which your body and clothing collect, connect your body to the ground via a resistor of some 1M ohms so that the electricity should discharge. Connect the resistor close to your body in the grounding line and protect yourself from electric shock hazard. Keep the fact in mind that static electricity is liable to be generated is 60% or more. Whenever such tool as a soldering iron is used for assembly, be sure to ground it.

(2) Neither bend nor twist the module excessively when installing it. Otherwise the device might break or the circuits fail.

(3) Protect the LCD, particularly the surface of polarizer, with a transparent plate (such acrylic or glass plate) on the casing.

(4) Don't fix LCD's surface on the casing by adhesive doubly coated tape etc.

## 8-3 Storage

(1) Avoid high temperature and high humidity. The temperature should be 0-35℃ and humidity be under 60%.

(2) Store the module in a dark place, out of direct sunlight and fluorescent lamp, etc.

(3) Keep the polarizer from any external forces.

(4) Store the module, keeping it in the box as it is on delivery or on the same conditions.

## 8-4 Operation

(1) The ICs would break down if the drive voltage exceeds the limit. Make sure of electrical specifications, particularly the supply voltage. Moreover, if the input connector of LCD module is joined/disjoined with the power of LCD module kept on, the internal circuit of LCD module might break down. So, be sure to join/disjoin the input connector with the power turned off.

(2) The response of the display is slow when the ambient temperature is below the lower limit, and the display becomes unusual when the ambient temperature is above the upper limit. In any case, it does not mean failure. It operates properly in the normal operating temperature range.

(3) The contrast of the liquid crystal display varies with the viewing angle, ambient temperature, and drive voltage. Adjust the drive voltage for the best contrast by installing external variable switch.

(4) If you move the module from a cold storage into the room as during test, moisture would condense on the module and it might fail.

(5) As IC on the module, CMOS IC has been used and the input terminals do not incorporate a pull-up/pull-down function. So, avoid to keep the input terminals OPEN state during power on condition.

(6) IC mounted ON LCD is very sensitive to a light and if it is exposed to an intensive light, a unusual display comes ON from time to time. When LCD display surface, especially IC chip itself is subjected to a light, a condition where the device is liable to make improper operation arises. So, give due consideration not to expose IC chip to a direct light.

## 8-5 Others

(1) Don't disassemble nor dismantle LCD module. As to any LCD module has ever been disassembled or dismantled at the user's side, WARRANTY provided by CITIZEN won't be applied.

(2) In such a case where the same display pattern is left on for a long time, there may be a slight residual image coming on. This residual image should disappear then any other display pattern is given or turn the power off and left the module as it is for a while. There is no problem in the reliability.

## SAFETY PRECAUTIONS  Be sure to observe the following instructions ON safety.

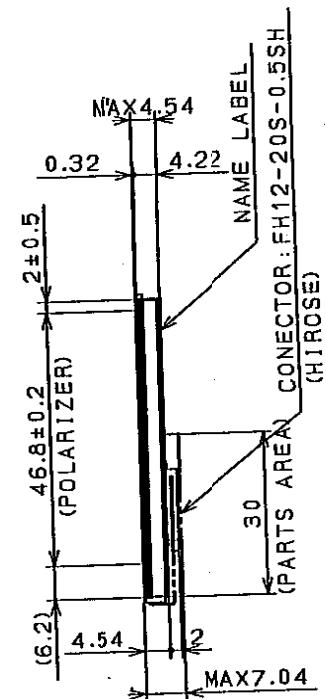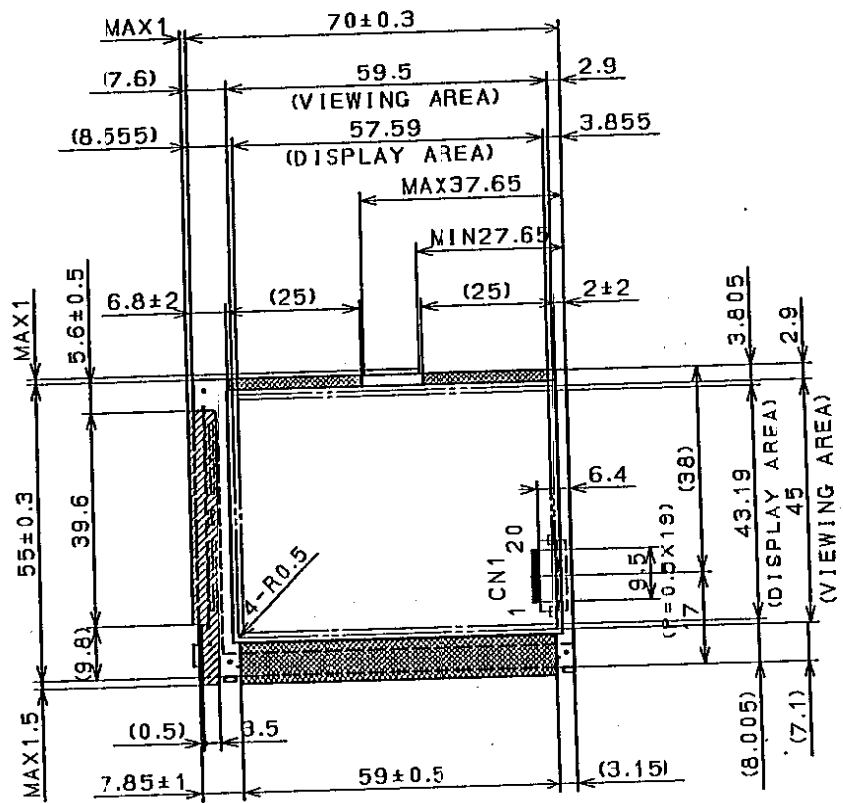| WARNING | ● Whenever mounting and demounting, be sure to turn OFF the power before proceeding with the work. Otherwise, you might get an electric shock. |
| --- | --- |
| CAUTION | ● Don't cover the device with a paper or cloth. Also, don't bring the device near to a combustible thing. Otherwise, a fire could be started<br>● Be careful not to drop the device, send a thing violently against the device, put undue stress ON the device and further, not to mar the device with thoughts far away. If broken, you get an injury as the case may be.<br>● Don't handle the device with a dirty hands or gloves, getting away          from water or oils. Otherwise, breakage of the device may result.<br>● Don't apply a paint. Otherwise, the device may become hot unusually.<br>● Don't use the device at a place where rain water or water droplets splash the device or where humidity is high. Otherwise, the device might break down. |

## NOTES

1. When the product mentioned in this specification sheet comes under "Foreign Exchange & Foreign Trade Control Law" , the permission by the Japanese government becomes necessary for exporting or taking the product out of Japan.

2. This product has been made with the intention of being used for the standard application, i.e., general electronic appliances (office appliances, communication apparatus, measuring apparatus, general household electric products and so on).

   The customers who intend to use the product for the applications that special quality and reliability are required and the failure or malfunction of the product jeopardizes the human life directly or could the human body in physical danger, that is, specific applications (for aviation and space, traffic apparatus, burning apparatus, life-sustaining equipment, safeties and so on) and who intend to make use of the product for other applications than the standard one provided by CITIZEN are requested to consult with the Sales Front of CITIZEN in advance.

3. In designing, especially for the maximum rating, operating supply voltage and radiation characteristic, it is requested to use the product within the guaranteed range. If your apparatus should fail on account of having been abused beyond the guaranteed values set by CITIZEN, we won't be responsible for it.

VIEWING DIRECTION

MAX1
70±0.3
59.5 (VIEWING AREA)
(7.6)
2.9
(8.555)
57.59 (DISPLAY AREA)
3.855
MAX37.65
MIN27.65
6.8±2
(25)
(25)
2±2
MAX1
5.6±0.5
55±0.3
39.6
4-R0.5
CN1 20
6.4
9.5
(P=0.5×19)
17
CN1 1
(9.8)
MAX1.5
(0.5)
3.5
7.85±1
59±0.5
(3.15)
3.805
2.9
43.19
(DISPLAY AREA)
45 (VIEWING AREA)
(38)
(8.005)
(7.1)

MAX4.54
NAME LABEL
0.32
4.22
2±0.5
46.8±0.2 (POLARIZER)
CONECTOR:FH12-20S-0.5SH (HIROSE)
(PARTS AREA)
30
(6.2)
4.54
2
MAX7.04

57.59 (320×RGB DOTS)
0.17
0.01
0.05
0.01
0.17
R G B R
0.01
43.19 (240 DOTS)
DOT DETAILS (50/1)

(6.7)
61.3±0.2 (POLARIZER)
2±0.5
Pattern Side (FPC or FFC)

| CN1 LIST | |
|---|---|
| NO. | NAME |
| 1 | VD3 |
| 2 | GND |
| 3 | DISP |
| 4 | FRAME |
| 5 | DF |
| 6 | LOAD |
| 7 | CP |
| 8 | D0 |
| 9 | D1 |
| 10 | D2 |
| 11 | D3 |
| 12 | D4 |
| 13 | D5 |
| 14 | D6 |
| 15 | D7 |
| 16 | VCON |
| 17 | NC |
| 18 | NC |
| 19 | LED K |
| 20 | LED A |

| | | | | | |
|---|---|---|---|---|---|
| | | Quantity | | Model: | K3247H-FL |
| | | Unit | 1／1 mm | | |
| | | Scale | 1／1 | Parts No.: | |
| | | | Date | Name | L10 |
| | | Drawn | SEP.04'01 | K.TANAKA | |
| | | Checked | | | Parts Name: |
| Mark Date Description Appro. | | Approved | | | LCD MODULE |
| Alterations | | | | | Drawing No.:3Z4I3110 |
| Material | | General Tolerances | | CITIZEN | |
| Heat Treatment | | Dimensions ±0.3 | | | |
| Hardness | | Angles | | CITIZEN WATCH CO.,LTD. TOKYO,JAPAN |