# SHARP

# LM8M64

## Color STN LCD Module

(Model Number: LM8M64)

## Specifications

Spec No.: LC98109A

Dated: May 31. 2002

| PREPARED BY: | DATE |
|---|---|
| APPROVED BY: | DATE |

# SHARP

LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

## SPECIFICATION

DEVICE SPECIFICATION for
Passive Matrix Color LCD Module
(640 × 240 dots)

Model No.
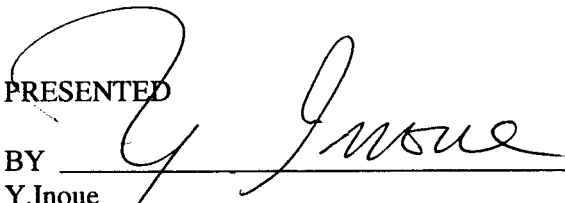
# LM8M64

☐CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY _____
Y.Inoue
DIVISION GENERAL MANAGER
DUTY LCD DEVELOPMENT CENTER
DUTY LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

# SHARP

| RECORDS OF REVISION | | | | DOC.FIRST ISSUE JAN.28.1998 |
|---|---|---|---|---|
| DATE | REF.PAGE PARAGRAPH DRAWING No. | REVISED NO. | SUMMARY | CHECK AND APPROVAL |
| 1998.11.27 | P17 | ⚠1 | Optical Characteristics Contrast ratio | *Inoue* |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# SHARP

○Precautions

1)    Industrial(Mechanical) design of the product in which this LCD module will be incorporated must be made so that the viewing angle characteristics of the LCD may be optimized.

This module's viewing angle is illustrated in Fig.1.

$\theta$ y MIN. < viewing angle < $\theta$ y MAX.

(For the specific values of $\theta$ y MIN., and $\theta$ y MAX., refer to the table9 )

Please consider the optimum viewing conditions according to the purpose when installing the module.



Viewing direction + $\theta$ y

$\theta$ y=0 ° (Normal line)

− $\theta$ y

Panel surface
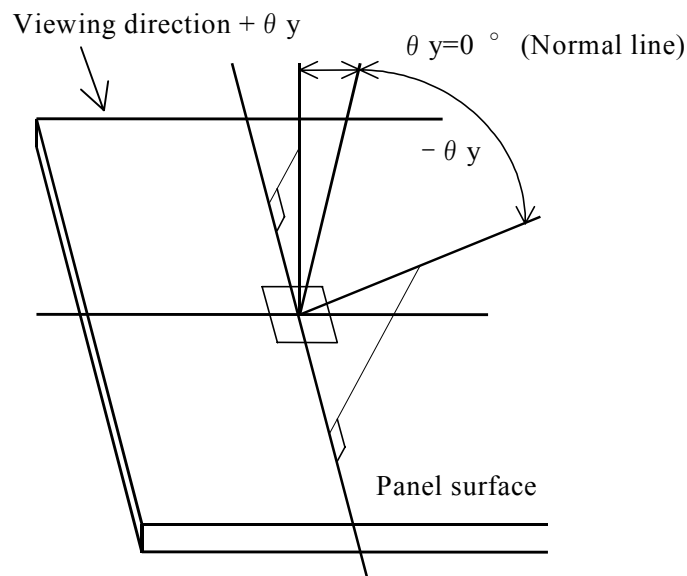
Fig.1 Definition of viewing angle

2)    When installing the module, pay attention and handle carefully not to allow any undue stress such as twist or

bend.

3)    Since the front polarizer is easily damaged. Please pay attention not to scratch on its face.

It is recommended to use a transparent acrylic resin board or other type of protective panel on the surface of the LCD module to protect the polarizer, LCD panel, etc..

4)    If the surface of the LCD panel is required to be cleaned, wipe it swiftly with cotton or other soft cloth. If it is not still clear completely, blow on and wipe it.

5)    Water droplets, etc. must be wiped off immediately since they may cause color changes, staining, etc.,    if it remained for a long time.

6)    Since LCD is made of glass substrate, dropping the module or banging it against hard objects may cause cracking or fragmentation.

7)    Since CMOS LSIs are equipped in this module, following countermeasures must be taken to avoid electrostatics charge.

1.Operator

Electrostatic shielding clothes shall be had because it is feared that the static electricity is electrified to human body in case that operator have a insulating garment.

2.Equipment

There is a possibility that the static electricity is charged to equipment which have a function of peeling or mechanism of friction(EX: Conveyer, soldering iron, working table), so the countermeasure countermeasure(electrostaticearth:$1 \times 10^8 \Omega$) should be made.

3.Floor

Floor is a important part to leak static electricity which is generated from human body or equipment. There is a possibility that the static electricity is charged to them without leakage in case of insulating floor, so the countermeasure(electrostatic earth:$1 \times 10^8 \Omega$) should be made.

4.Humidity

Humidity of working room may lower electrostatics generating material's resistance and have something to prevent electrifying. So, humidity should be kept over 50% because humidity less than 50 % may increase material's electrostatic earth resistance and it become easy to electrify.

5.Transportation/storage

The measure should be made for storage materials because there is a possibility that the static electricity, which electrify to human body or storage materials like container by friction or peeling, cause the dielectric charge.

6.Others

The laminator is attached on the surface of LCD module to prevent from scratches, fouling and dust. It should be peeled off unhurriedly with using static eliminator.

And also, static eliminator should be installed to prevent LCD module from electrifying at assembling line.

8)   Don't use any materials which emit gas from epoxy resin(amines' hardener) and silicon adhesive agent(dealcohol or deoxym) to prevent change polorizer color owing to gas.

9)   Since leakage current, which may be caused by routing of CCFT cables, etc., may affect the brightness of display, the inverter has to be designed taking the leakage current into consideration. Thorough evaluation of the LCD module/inverter built into its host equipment shall be conducted, therefore, to ensure the specified brightness.

10)   Avoid to expose the module to the direct sun-light, strong ultraviolet light, etc. for a long time.

11)   If stored at temperatures under specified storage temperature, the LC may freeze and be deteriorated. If storage temperature exceed the specified rating, the molecular orientation of the LC may change to that of a liquid, and they may not revert to their original state. Therefore, the module should be always stored at normal room temperature.

12)  Disassembling the LCD module can cause permanent damage and should be strictly avoided.

13) Procedure insert mating connector

When the mating connector is inserted, it should be parallel to the used connector of LCD module and it should be inserted horizontally.

When the mating connector is attempted to be fixed to LCD connector, it should be inserted properly in order not to create a gap as shown "A".

Please insert the connector as both edge is placed to the connect position of LCD connector.



LCD Connector



Parallel    LCD Connector

A    LCD Connector
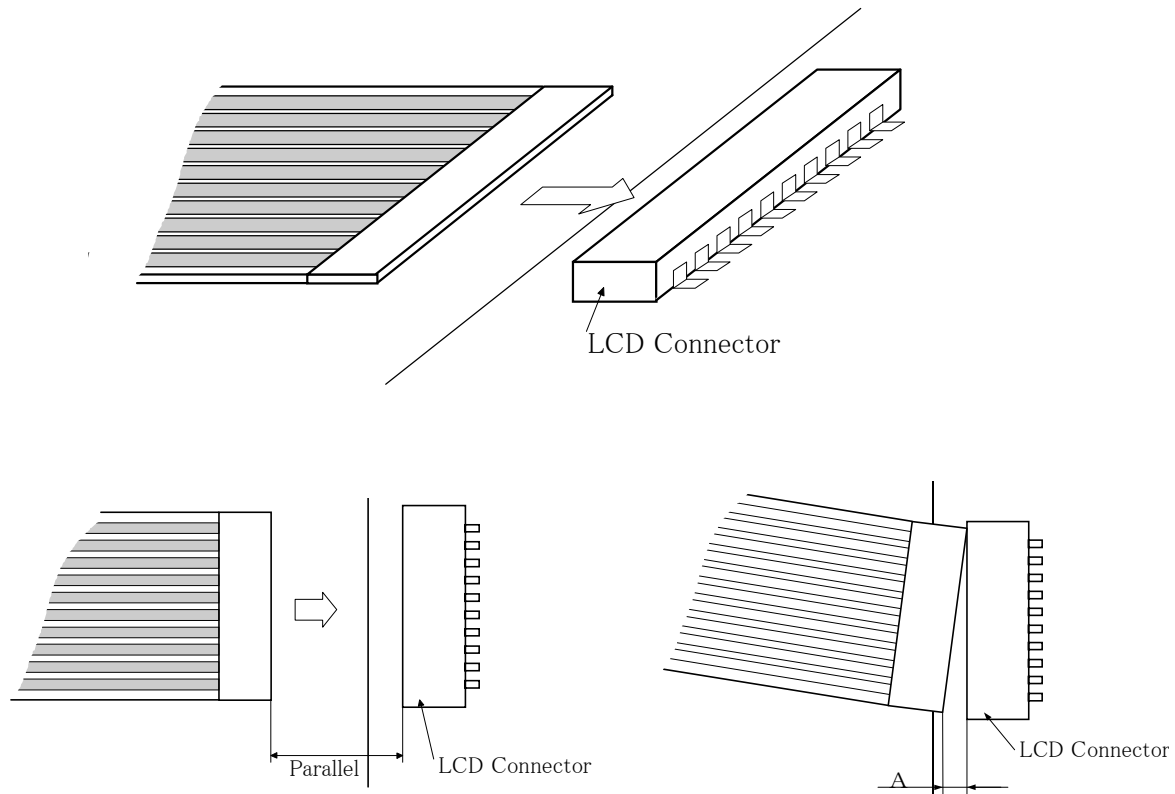
14) This specification describes display quality in case of no gray scale. Since display quality can be affected by gray scale methods, display quality shall be carefully evaluated for the usability of LCD module in case gray scale is displayed on the LCD module.

15)    The module should be driven according to the specified ratings to avoid permanent damage.
DC voltage drive leads to rapid deterioration of LC, so ensure that the drive is alternating waveform by continuous application of the signal M. Especially the power ON/OFF sequence shown on Page 24 should be kept to avoid latch-up of drive LSIs and application of DC voltage to LCD panel.

○Contents

1.Application
  This data sheet is to introduce the specification of LM8M64, passive Matrix type Color LCD module.

  2.Construction and Outline
  Construction: $640 \times 240$ dots color display module consisting of an LCD panel, PWB(printed wiring board) with
                electric components mounted onto, TCP(tape carrier package) to connect the LCD panel and PWB
                electrically, and plastic chassis with CCFT back light and bezel to fix them mechanically.
                Signal ground(Vss) is connected with the metal bezel.
                DC/DC converter is built in.

LCD Panel          PWB          Bezel

TCP

Bezel          Light Pipe          CCFT
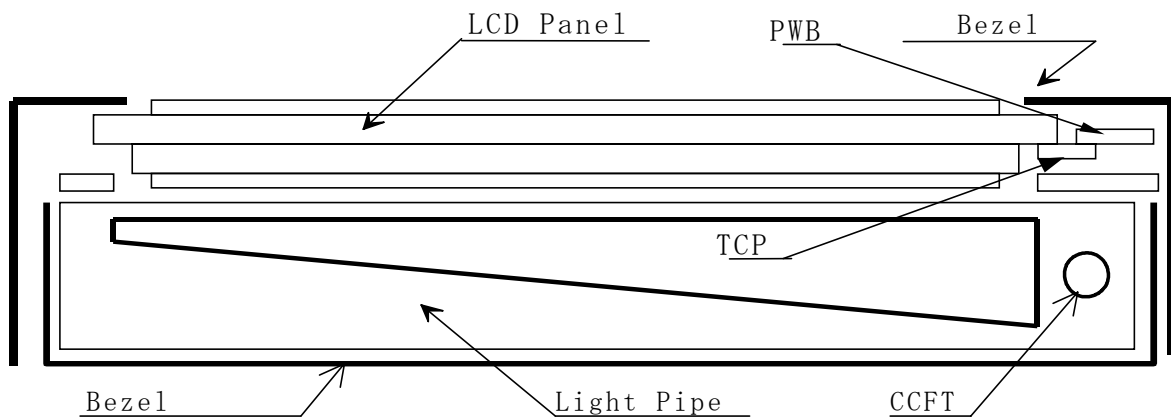
Fig.2   Module structure

       Outline          :See Fig. 16
       Connection       :See Fig. 16 ,Table 6 and Table 7


    The LCD module shall meet the following inspection standard :   S-U-035

3.Mechanical Specification

Table1

| Parameter | Specifications | Unit |
|---|---|---|
| Outline dimensions | 225.4(W)×87.4(H)×7.0MAX(D) | mm |
| Active area | 191.98(W)×71.98(H) | mm |
| Display format | 640(W)×240(H) | - |
| Dot size | 0.08×RGB(W)×0.28(H) | mm |
| Dot spacing | 0.02 | mm |
| Base color  *1 | Normally black  *2 | - |
| Weight | Approx.175 | g |

*1   Due to the characteristics of the LC material, the colors vary with environmental temperature.

*2   Negative-type display

Display data "H" : ON   → transmission

Display data "L" : OFF   → light isolation

4.Absolute Maximum Ratings

 4-1.Electrical absolute maximum ratings

Table 2

| Parameter | Symbol | MIN. | MAX. | Unit | Remark |
|---|---|---|---|---|---|
| Supply voltage(Logic) | $V_{DD}$-$V_{SS}$ | 0 | 6.0 | V | Ta=25 ℃ |
| Input voltage | $V_{IN}$ | -0.3 | $V_{DD}$+0.3 | V | Ta=25 ℃ |
| Vcon voltage | Vcon | 0 | $V_{DD}$ | V | Ta=25 ℃ |

4-2.Environment Conditions

Table 3

| Item | Tstg | | Topr | | Remark |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| Ambient temperature | -25 ℃ | +60 ℃ | 0 ℃ | +40℃ | Note 4) |
| Humidity | Note 1) | | Note 1) | | No condensation |
| Vibration | Note 2) | | Note 2) | | 3 directions(X/Y/Z) |
| Shock | Note 3) | | Note 3) | | 6 directions($\pm$X$\pm$Y$\pm$Z) |

Note 1)　Ta$\leqq$40 ℃.......95 % RH Max.

　　　　Ta$>$40 ℃.......Absolute humidity shall be less than Ta=40 ℃/95 % RH.

Note 2)

Table 4

| Frequency | 10 Hz$\sim$57 Hz | 57 Hz$\sim$500 Hz |
|---|---|---|
| Vibration level | - | 9.8 m/s$^2$ |
| Vibration width | 0.075 mm | - |
| Interval | 10 Hz$\sim$500 Hz$\sim$10 Hz/11.0 min | |

　　　2 hours for each direction of X/Y/Z (6 hours as total)

Note 3)　Acceleration　:　490 m/s$^2$
　　　　Pulse width　:　11 ms
　　　　3 times for each directions of $\pm$X/$\pm$Y/$\pm$Z

Note 4)　Care should be taken so that the LCD module may not be subjected to the temperature out of this specification.

5.Electrical Specifications
5-1.Electrical characteristics

<u>Table 5</u>      Ta=25 ℃      VDD= 3.3 V ± 10 %      1/tFRM=90 Hz

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Supply voltage (Logic) | $V_{DD}$-$V_{SS}$ | Ta = 0~40 ℃ (Note 1) | | 3.0 | 3.3 | 3.6 | V |
| Contrast adjust voltage (Note 4) | Vcon -$V_{SS}$ | Ta = 0~40 ℃ | | 0.8 | 1.95 | 2.8 | V |
| Input signal voltage | $V_{IN}$ | "H" level | Ta = 0~40 ℃ | $0.8V_{DD}$ | - | $V_{DD}$ | V |
| | | "L" level | | 0 | - | $0.2V_{DD}$ | V |
| Supply current | $I_{DD}1$(TYP.) | Ta =25 ℃(Note 1,2) | | - | 22 | 33 | mA |
| | $I_{DD}2$(MAX.) | Ta=25 ℃(Note1,3) | | - | 32 | 48 | mA |
| Rush current (Logic) | Irush | Ta =25 ℃ (Note 1) | | 100mA×50ms | | | |
| Ripple current (Logic) | Irip | Ta =25 ℃ (Note 1) | | 50mA×150 $\mu$ s | | | |
| Power consumption | Pd1(TYP) | Note 2) | | - | 73 | 109 | mW |
| | Pd2(MAX) | Note 3) | | - | 105 | 158 | mW |

Note 1) Under the following conditions.;
　　　① Immediately after the rise of $V_{DD}$ .　　　　　　　　　　:100mA×50ms
　　　② Under the situation that DISP signal is on and kept steady  : 50mA×150 $\mu$ s

Note 2) Frame frequency = 90 Hz, Vcon - Vss =max contrast voltage
　　　Display pattern = all digits ON (D0-7 = "H" )

□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□

Note 3) Frame frequency = 90 Hz, Vcon - Vss = max contrast voltage
　　　Display pattern = 1bit checker

□■□■□■□■□■□■□■□■□■□■
■□■□■□■□■□■□■□■□■□■□
□■□■□■□■□■□■□■□■□■□■
■□■□■□■□■□■□■□■□■□■□

Note 4) Contrast adjust voltage "Vcon-Vss" is transformed into the LCD driving voltage "$V_{LCD}$" by following circuit built in the LCD module.
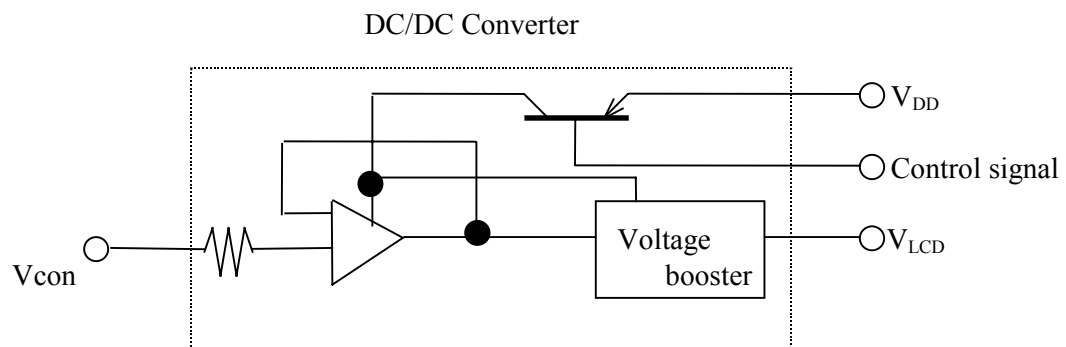
DC/DC Converter



Fig.3 Voltage generator for optimum contrast

5-2.Interface signals

○LCD                                     Table 6

| Pin No. | Symbol | Description | Level |
|---|---|---|---|
| 1 | YD | Scan start-up signal | "H" |
| 2 | VSS | Ground potential | - |
| 3 | LP | Input data latch signal | "H" → "L" |
| 4 | VSS | Ground potential | - |
| 5 | XCK | Shift clock for input data | "H" → "L" |
| 6 | VSS | Ground potential | - |
| 7 | DISP | Display control signal | H(ON), L(OFF) |
| 8 | VDD | Power supply for logic(3.3v) | - |
| 9 | Vcon | Contrast adjustment voltage | - |
| 10 | VSS | Ground potential | - |
| 11 | D0 | Display data signal | H(ON), L(OFF) |
| 12 | D1 | Display data signal | H(ON), L(OFF) |
| 13 | D2 | Display data signal | H(ON), L(OFF) |
| 14 | D3 | Display data signal | H(ON), L(OFF) |
| 15 | VSS | Ground potential | - |
| 16 | D4 | Display data signal | H(ON), L(OFF) |
| 17 | D5 | Display data signal | H(ON), L(OFF) |
| 18 | D6 | Display data signal | H(ON), L(OFF) |
| 19 | D7 | Display data signal | H(ON), L(OFF) |
| 20 | VDD | Power supply for logic(3.3v) | - |

○CCFT                                     Table7

| Pin No | Symbol | Description | Level |
|---|---|---|---|
| 1 | VL1(HV) | High voltage line (from Inverter) | - |
| 2 | NC | NC | - |
| 3 | VL2(GND) | Ground line (from Inverter) | - |

5-3.Connectors

   ○LCD
        Used            connector :   FH12-20S-0.5SH(HIROSE)
        Correspondable connector :   FFC-CONNECTOR(0.5mm pitch   20pin)
   ○CCFT
        Used connector           :HV-2S-C1(JAE)
        Correspondable connector  :HV-2P-HF-E1400(JAE)

   Except above connector shall be out of guaranty.

Fig.4 Dot chart of display area



(1, 1)  (1, 2)   COLUMN   (1, 639)  (1, 640)

(2, 1)  (2, 2)   (2, 639)  (2, 640)

ROW

640 × 3 (RGB)
× 240 dots

(239, 1) (239, 2)   (239, 639) (239, 640)

(240, 1) (240, 2)   (240, 639) (240, 640)

LP × 244 pulses

YD

LP

D0
〜
D7 : 1st line's display data / 2nd line's display data / 244th line's display data / 1st line's display data / 2nd line's display data

XCK × 640 × (3/8) pulses

LP

XCK

XCK

| | | | | | | |
|---|---|---|---|---|---|---|
| D7 | R(1,1) | B(1,3) | G(1,6) | R(1,9) | B(1,11) | G(1,14) |
| D6 | G(1,1) | R(1,4) | B(1,6) | G(1,9) | R(1,12) | B(1,14) |
| D5 | B(1,1) | G(1,4) | R(1,7) | B(1,9) | G(1,12) | R(1,15) |
| D4 | R(1,2) | B(1,4) | G(1,7) | R(1,10) | B(1,12) | G(1,15) |
| D3 | G(1,2) | R(1,5) | B(1,7) | G(1,10) | R(1,13) | B(1,15) |
| D2 | B(1,2) | G(1,5) | R(1,8) | B(1,10) | G(1,13) | R(1,16) |
| D1 | R(1,3) | B(1,5) | G(1,8) | R(1,11) | B(1,13) | G(1,16) |
| D0 | G(1,3) | R(1,6) | B(1,8) | G(1,11) | R(1,14) | B(1,16) |

\* Electrical and optical characteristics are specified by above condition.

Fig. 5    Data input timing chart

YD

LP

LP

XCK

D0～7

$V_{IH} = 0.8\ V_{DD}$
$V_{IL} = 0.2\ V_{DD}$

Fig.6 Interface timing chart
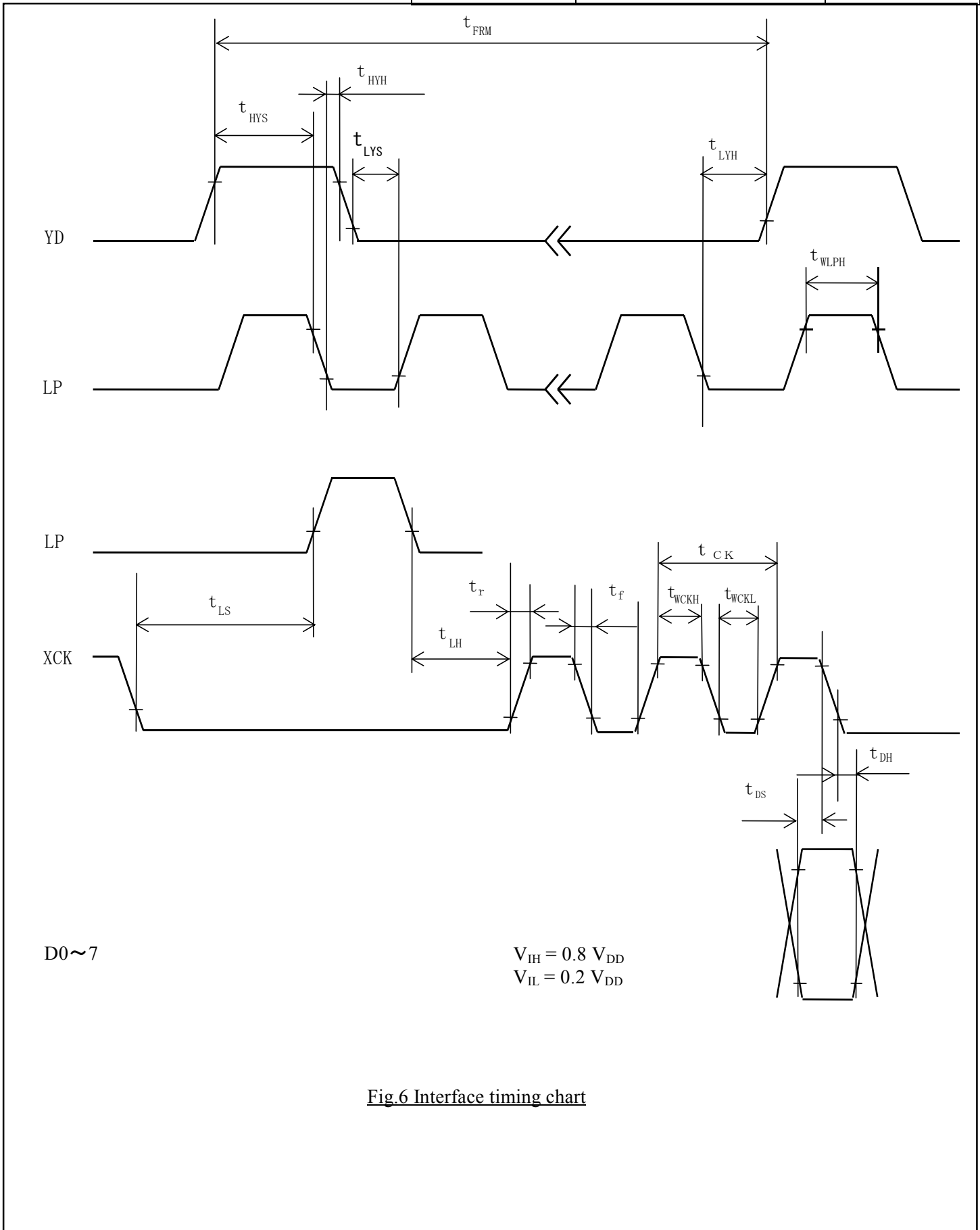
Table 8 Interface timing ratings

Ta=25 ℃,VDD=3.3 V±10 %

| Item | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Frame cycle　*2,*3 | $t_{FRM}$ | 8.33 | | 16.94 | ms |
| XCK signal clock cycle | $t_{CK}$ | 82 | | | ns |
| "H" level clock width | $t_{WCKH}$ | 30 | | | ns |
| "L" level clock width | $t_{WCKL}$ | 30 | | | ns |
| LP signal "H" level pulse width | $t_{WLPH}$ | 350 | | | ns |
| Data set up time | $t_{DS}$ | 25 | | | ns |
| hold time | $t_{DH}$ | 30 | | | ns |
| YD signal "H" level set up time | $t_{HYS}$ | 125 | | | ns |
| "H" level hold time | $t_{HYH}$ | 125 | | | ns |
| "L" level set up time | $t_{LYS}$ | 100 | | | ns |
| "L" level hold time | $t_{LYH}$ | 100 | | | ns |
| LP↑　allowance time from XCK↓ | $t_{LS}$ | | | 5 | ns |
| LP↓　allowance time from XCK↑ | $t_{LH}$ | 0 | | | ns |
| Input signal rise/fall time　*1 | $t_r, t_f$ | | | 20 | ns |

*1　When LCD module is operated by high speed of XCK(Shift clock), ($t_{CK}$ - $t_{WCKH}$ -$t_{WCKL}$) /2 is maximum.

*2　LCD module functions at the minimum frame cycle of 8.33 ms(Maximum frame frequency of 120 Hz).
Owing to the characteristics of LCD module, "shadowing" will become more eminent as frame frequency goes up, while flicker will be reduced.

*3　According to our experiments, frame cycle of 8.33 ms Min. or frame frequency of 120 Hz Max. will demonstrate optimum display quality in terms of flicker and "shadowing". But since judgment of display quality is subjective and display quality such as "shadowing" is pattern dependent, it is recommended that decision of frame frequency, to which power consumption of the LCD module is proportional, be made based on your own through testing on the LCD module with every possible patterns displayed on it

※　The intervals of one LP fall and next must be always the same, and LPs must be input continuously. The intervals must be 70 μ s Max.

6. Module Driving Method
  6-1. Circuit configuration
      Fig.12 shows the block diagram of the module's circuitry.

  6-2. Display face configuration
      The display consists of $640 \times 3$(R,G,B)$\times 240$ dots as shown in Fig. 4.
      The interface is single panel with double drive to be driven at 1/244duty ratio.

  6-3. Input data and control signal
      The LCD driver is 240 bits LSI, consisting of shift registers, latch circuits and LCD driver circuits. Input data
      for each row $640 \times 3$ (R,G,B) will be sequentially transferred in the form of 8 bit parallel data through
      shift registers from top left of the display together with clock signal (XCK).

      When input of one row $640 \times 3$ (R,G,B) is completed, the data will be latched in the form of parallel
      data corresponding to the signal electrodes by the falling edge of latch signal (LP) then, the corresponding
      drive signals will be transmitted to the $640 \times 3$ lines of column electrodes of the LCD panel by the LCD
      drive circuits.
      At this time, scan start-up signal (YD) has been transferred from the scan signal driver to the 1st row of scan
      electrodes, and the contents of the data signals are displayed on the 1st row of the display face according to
      the combinations of voltages applied to the scan and signal electrodes of the LCD. While the data of 1st row
      are being displayed, the data of 2nd row are entered. When data for $640 \times 3$ dots have been transferred, they
      will be latched by the falling edge of LP, switching the display to the 2nd row.

      Such data input will be repeated up to the 244th row of each display segment, from upper row to lower
      rows, to complete one frame of display by time sharing method.

      Then data input proceeds to the next display frame.

      YD generates scan signal to drive horizontal electrodes.

      Since DC voltage, if applied to LCD panel, causes chemical reaction in LC materials, causing deterioration of
      the materials, drive wave-form shall be inverted at every display frame to prevent the generation of such DC
      voltage.
      Control signal M plays such a role.

      Because of the characteristics of the CMOS driver LSI, the power consumption of the display module goes up
      with the clock frequency of XCK.
      To minimize data transfer speed of XCK clock the LSI has the system of transferring 8 bit parallel data
      through the 8 lines of shift registers.
      Thanks to this system the power consumption of the display module is minimized.

      In this circuit configuration, 8 bit display data shall input to data input pins of D0-7 .

      Furthermore, the display module has bus line system for data input to minimize the power consumption with
      data input terminals of each driver LSI being activated only when relevant data input is fed.

      Data input for column electrodes and chip select of driver LSI are made as follows:

The driver LSI at the left end of the display face is first selected, and the adjacent driver LSI right next side is selected when data of 240 dot (30XCK) is fed. This process is sequentially continued until data is fed to the driver LSI at the right end of the display face. This process is followed simultaneously both at the top and bottom column drivers LSI's.

Thus data input will be made through 8 bit bus line sequentially from the left end of the display face.

Since this display module contains no refresh RAM, it requires the above data and timing pulse inputs even for static display.

The timing chart of input signals are shown in fig. 6 and Table 8.

7.Optical Characteristics ⚠1

Following spec are based upon the electrical measuring conditions, on which the contrast of perpendicular direction( $\theta x = \theta y = 0°$ ) will be MAX..

<p align="center">Table 9      Ta = 25 ℃, V<sub>DD</sub>= 3.3V, Vcon-V<sub>SS</sub> = Vmax</p>

| Parameter | | Symbol | Condition | | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Viewing angle range | | $\theta$ x | Co>5.0 | $\theta$ y = 0 ° | -30 | - | 30 | | Note 1) |
| | | $\theta$ y | | $\theta$ x = 0 ° | -15 | - | 25 | | |
| Contrast ratio | | Co | $\theta$ x = $\theta$ y = 0 ° | | 30 | 50 | - | - | Note2) |
| Response time | Rise | $\tau$ r | $\theta$ x = $\theta$ y = 0 ° | | - | 270 | 400 | ms | Note3) |
| | Decay | $\tau$ d | $\theta$ x = $\theta$ y = 0 ° | | | 80 | 100 | ms | |
| Module chromaticity | White | x | $\theta$ x = $\theta$ y = 0 ° | | - | 0.275 | - | - | |
| | | y | $\theta$ x = $\theta$ y = 0 ° | | - | 0.320 | - | - | |

Note 1) The viewing angle range is defined as shown Fig.7.

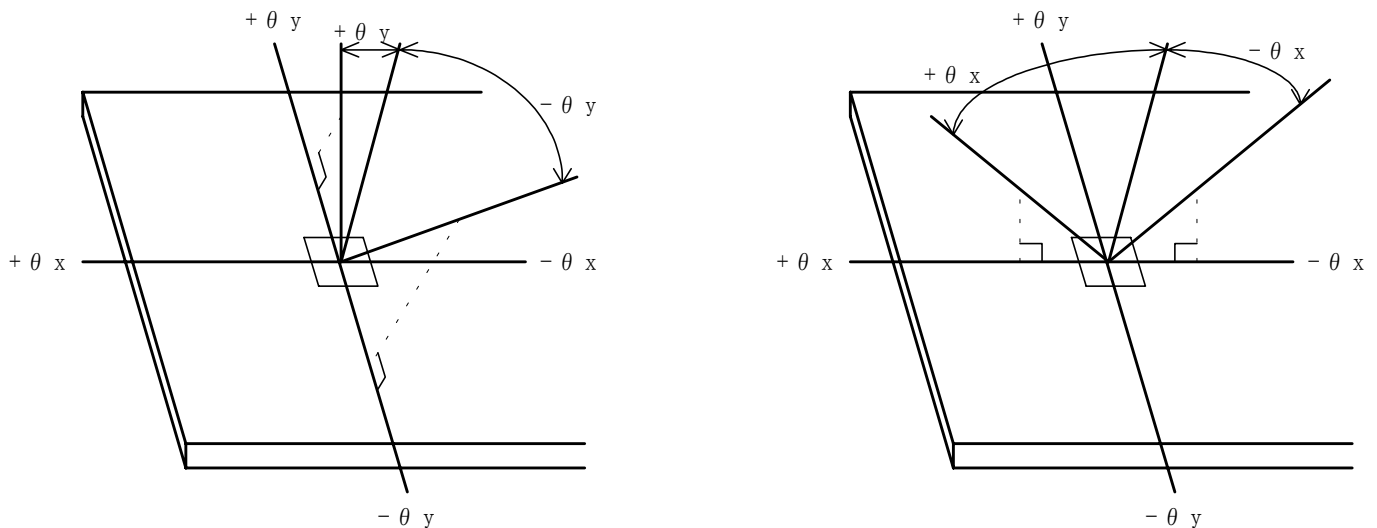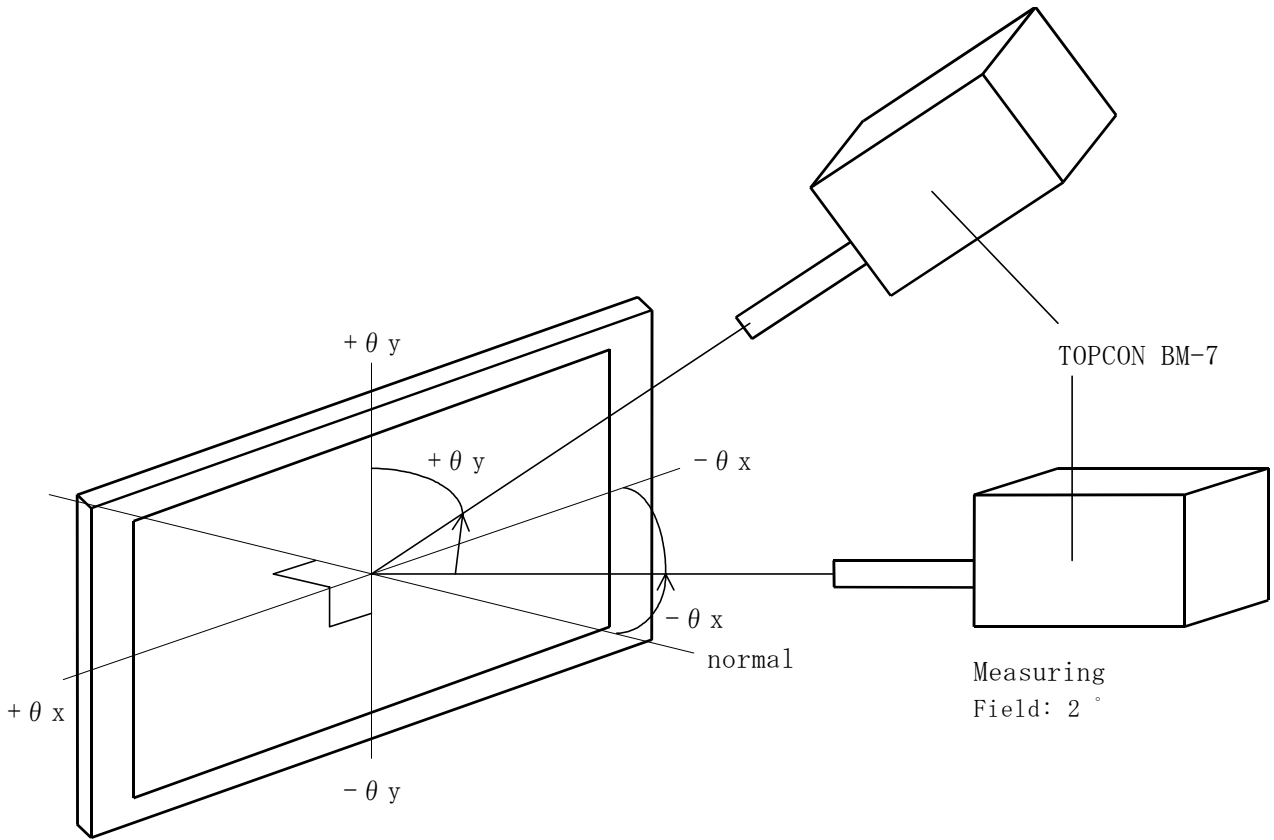

<p align="center">Fig.7    Definition of Viewing Angle</p>

Note 2) Contrast ratio is defined as follows:

$$Co = \frac{\text{Luminance(brightness) all pixes "White" at Vmax}}{\text{Luminance(brightness) all pixes "dark " at Vmax}}$$

Vmax is defined in Fig.9.

Note 3) The response characteristics of photo-detector output are measured as shown in Fig.10, assuming that input signals are applied so as to select and deselect the dot to be measured, in the optical characteristics test method shown in Fig.8.

Measuring Spot Size :　$\phi$ 10 mm

　$\theta$ x :　Angle from "normal" to viewing surface rotated about the horizontal axis.

　$\theta$ y :　Angle from "normal" to viewing surface rotated about the vertical axis.

Fig.8　Optical Characteristics Test Method　I
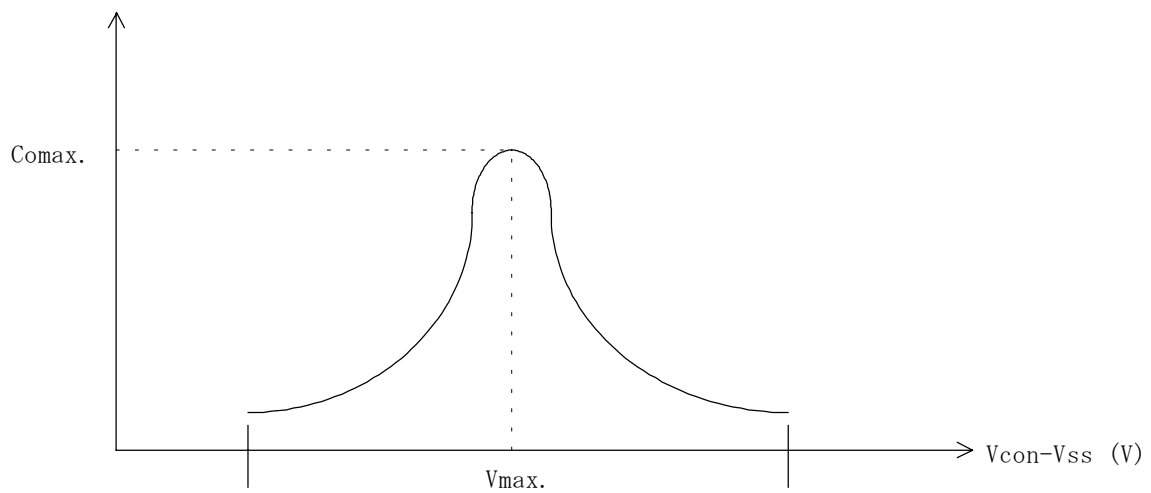


Fig.9 Definition of Vmax

(Response Measurement)
Ta = 25 ℃
In dark room

TOPCON BM7 + quartz fiber



θ y(+)

85 mm

θ x(-)

Computer

θ x(+)

A/D Converter

θ y(-)

LCD Control circuit

LCD Module

normal
θ x= θ y= 0°
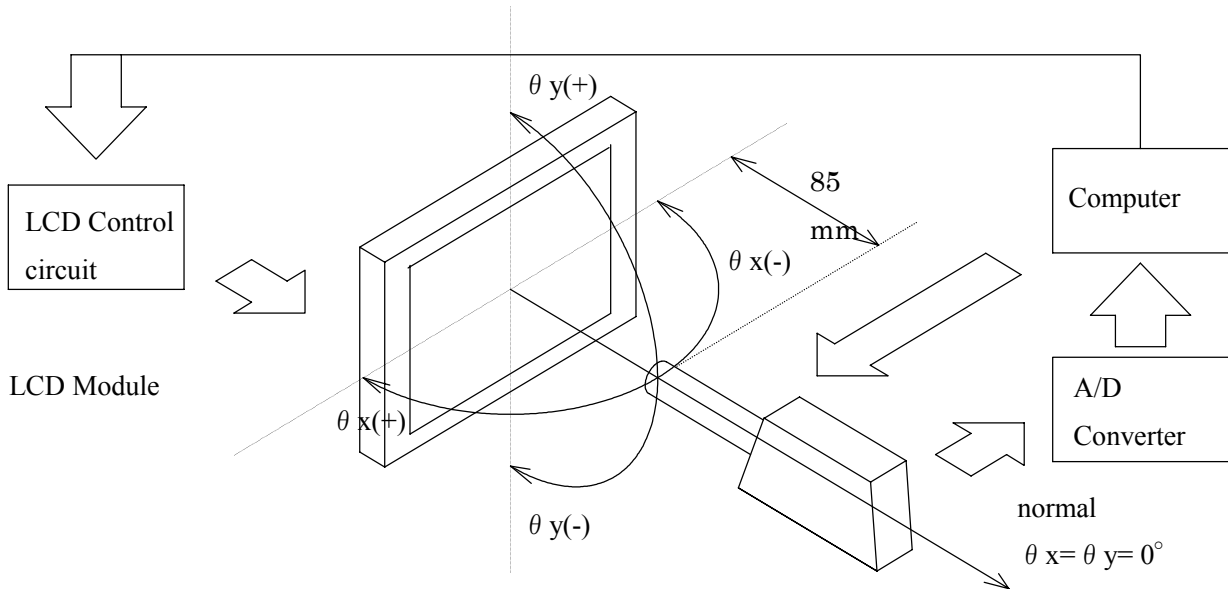
(Measuring spot size : φ 10 mm, Measuring Field : 2 ° )

Fig. 10 Optical Characteristics Test Method Ⅱ

[Drive waveform]

1/244 Duty Ratio

Driving voltage

Non-select waveform

Select waveform

Non-select waveform

[Responce waveform]

Photo detector output

100 %

90 %

10 %

$\tau$ r

$\tau$ d

$\tau$ r : Rise time

$\tau$ d : Decay time

Fig.11 Definition of Response time

V_CON

V_DD

V_SS

Bias genetator
&
Protection circuit

ON/OFF CONT.

M general circuit
&
Sequence control
circuit

DISP

M

DISP

LP

YD

XCK

D0～D7

(1,1)(1,2)          (1,640)
(2,1)(2,2)          (2,640)

R | G | B

640X240 DOTS LCD

(240,1)          (240,640)
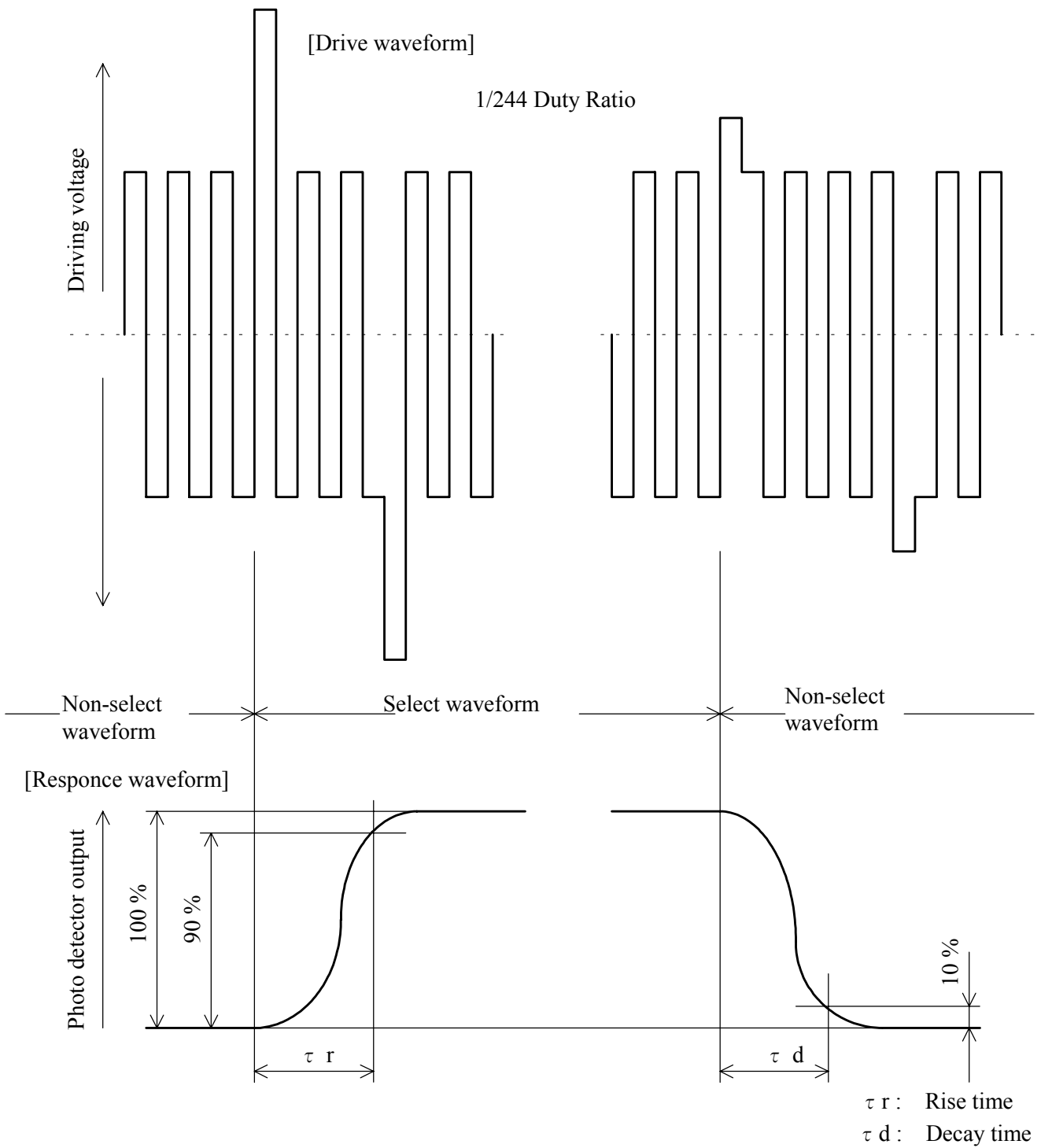
COM Drivers

SEG Drivers

CCFT

CCFT
Inverter

Fig. 12 Circuit block diagram

8.Characteristics of Backlight

The ratings are given on condition that the following conditions are satisfied.

8-1.Rating(Note)                    Table10

| Parameter | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|
| Brightness | 70 | 80 | - | $cd/m^2$ |

8-2.Measurement circuit : CXA-K0505-VJL(TDK)     (at   IL = 1.9mArms)

8-3.Measurement equipment :   BM-7 (TOPCON Corporation)

8-4.Measurement conditions

1).   Measurement circuit voltage :   DC = 5.0 V,   at primary side

2).   LCD: All digits WHITE,   VDD= 3.3 V,   Vcon-VSS = Vmax, D0-7="H"(White)

Frame Frequency 90 Hz

3).   Ambient temperature :   25 ℃

Measurement shall be executed 30 minutes after turning on.

8-5.Used lamp :   FAC1EX/207T2G1I/S/U(TOSHIBA LIGHTING&TECHNOLOGY CORP)

Used cable :   UL3579,AWG#26 or UL3587,AWG#26

(NISSEI ELECTRIC CO.,LTD or SUMITOMO ELECTRIC INDUSTRIES LTD.)

(1)Rating (1pc)                    Table11

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| Lamp voltage | $V_L$ | - | 500 | 550 | Vrms | |
| Lamp current | $I_L$ | - | 1.9 | 2.0 | mArms | *1 |
| Lamp power consumption | $P_L$ | - | 0.95 | 1.05 | W | *2 |
| Lamp frequency | $F_L$ | 45 | - | 100 | kHz | - |
| Kick-off voltage | $V_S$ | - | - | - | Vrms | Ta=25 ℃ |
| | | - | - | 1,300 | Vrms | Ta= 0 ℃*3 |
| Lamp life time | $L_L$ | 10 000 | - | - | h | Ta=25 ℃*4 $I_L$=2mArms |

Within no conductor closed. (CCFT only)

*1   It is recommended that IL be not more than 2.0mArms so that heat radiation of CCFT backlight may least affect the display quality.

*2   Power consumption excluded inverter loss.

*3   The circuit voltage(VS) of the inverter should be designed to have some margin, because VS may be increased due to the leak current in case of the LCD module.

*4   Average life time of CCFT will be decreased when LCD is operating at lower and higher temperature.

(2)Operating life

The operating life time is 10 000 hours or more at 2.0 mA.
 (Operating life with CXA-K0505-VJL or equivalent.)
The inverter should meet the following conditions to keep the specified life time of used lamp;
 -Since, symmetric waveform without spike in positive and negative
 -Output frequency range:  45 kHz-100 kHz
Make sure the operating conditions by executing the burn-in enough time.
The operating life time is defined as having ended when any of the following conditions occur; $25\pm1℃$
 -When the voltage required for initial discharge has reached 110 % of the initials value.
 -When the illuminence quantity of light has decreased to 50 % of the initials value.

(NOTE) Rating are defined as the average brightness inside the viewing area specified in Fig.13.
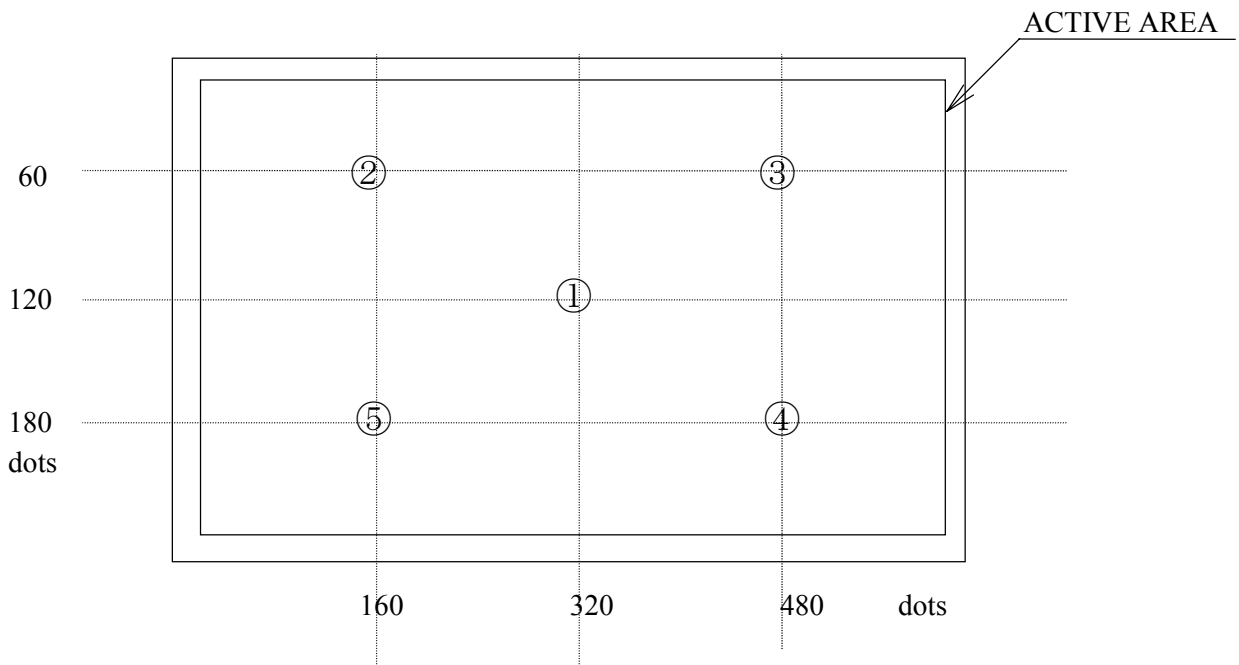


Fig.13 Measuring points (1-5)

9.Lot Number

Lot number is shown at the position mentioned in Fig.14 in accordance with the following numbering rule.
 (Example)  98  A  00001

Serial number(Missing number exist)
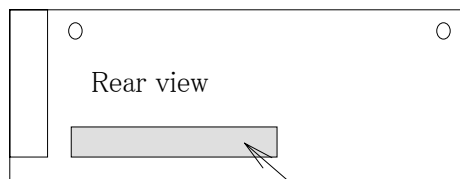Production month(A=Jan.,B=Feb.···,L=Dec.)
Production year



Fig.14                Model and Serial number

10.Supply voltage sequence condition
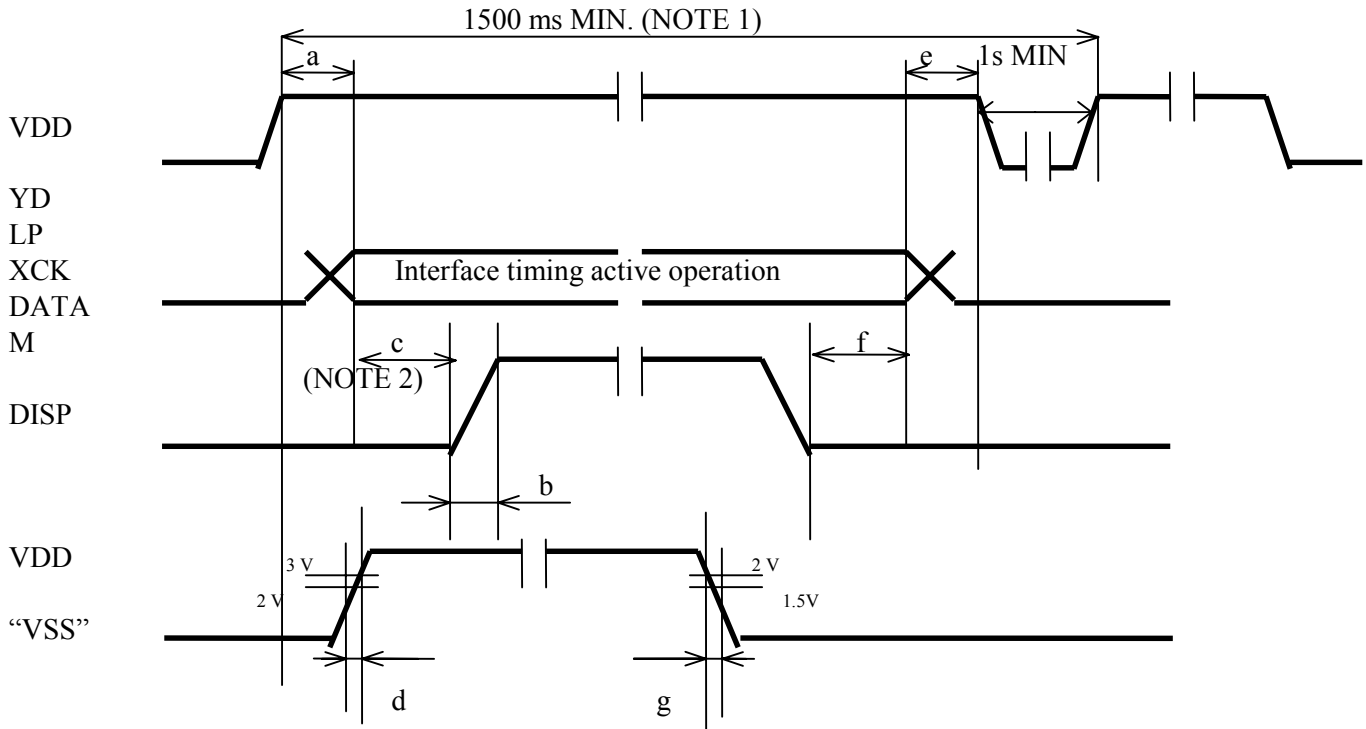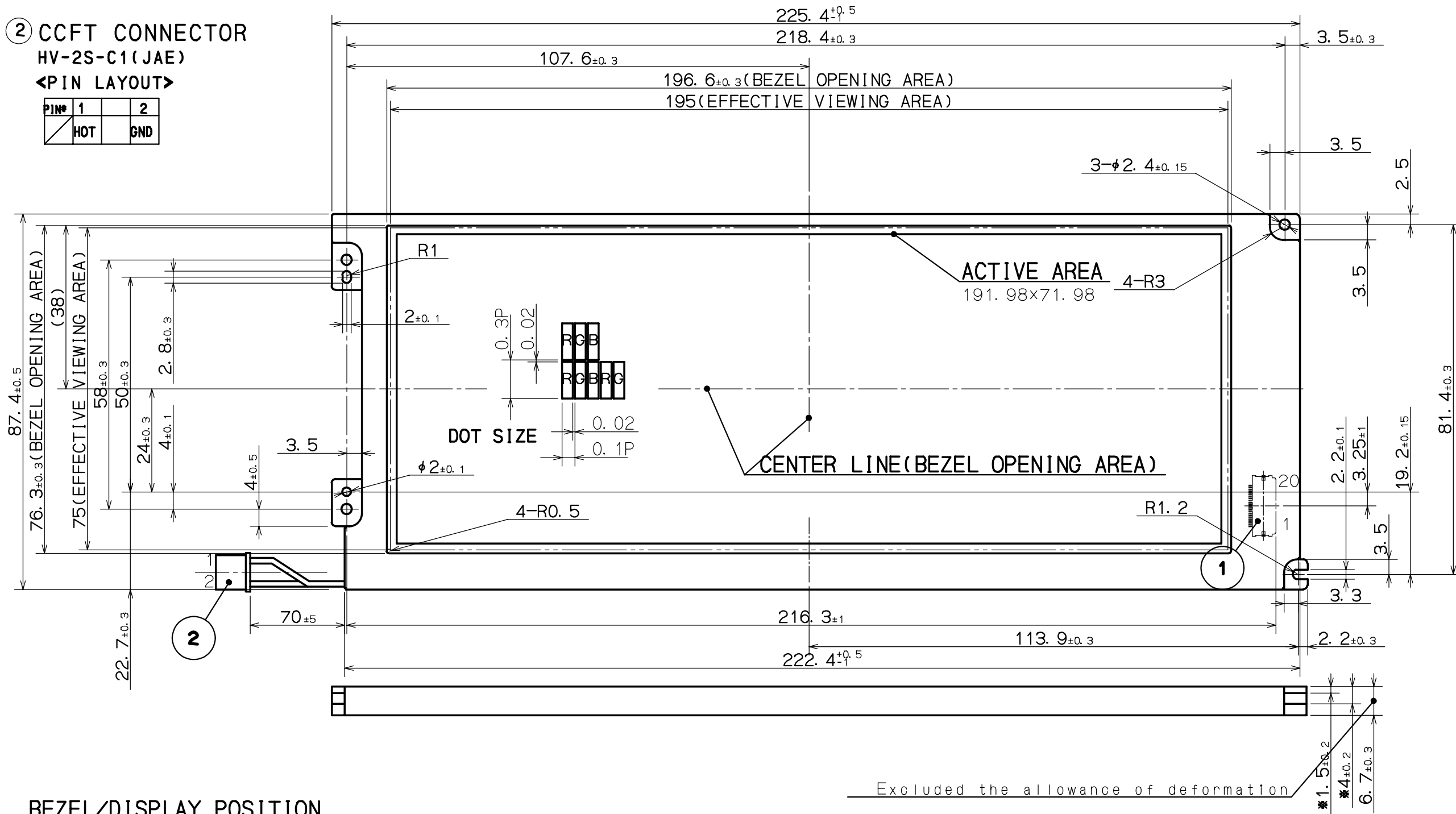


Fig.15 Supply voltage sequence condition

| | POWER ON | |
| --- | --- | --- |
| Symbol | Allowable value | |
| a | 0 ms MIN. | 1 s MAX. |
| b | — | 100 ns MAX. |
| c | 50 ms MIN. | - |
| d | - | 10 ms MAX. |

| | POWER OFF | |
| --- | --- | --- |
| Symbol | Allowable value | |
| e | 0 ms MIN. | 1 s MAX. |
| f | 0 ms MIN. | 1 s MAX. |
| g | 15 ms MIN. | — |

(NOTE 1)   Power ON/OFF cycle time. All signals and power line shall be in accordance with above sequence in case of power ON/OFF.

(NOTE 2)   Before DISP rise up, the signals of YD,LP,XCK,DATA and M must be input, and the above condition of "a" must be satisfied. The signals which comply with the interface timing in Fig.5,Fig.6, and table 8, must be input.
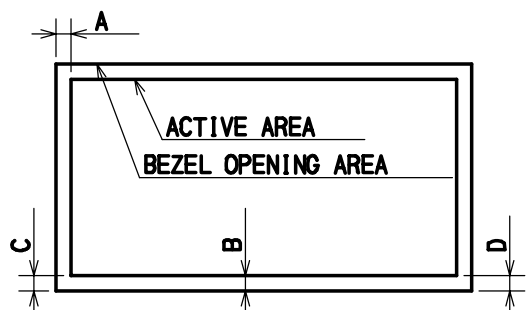
② CCFT CONNECTOR

HV-2S-C1(JAE)

<PIN LAYOUT>

| PIN# | 1 | 2 |
|---|---|---|
| | HOT | GND |

225.4$^{+0.5}_{-1}$

218.4±0.3

107.6±0.3

196.6±0.3(BEZEL OPENING AREA)

195(EFFECTIVE VIEWING AREA)

3.5±0.3

3.5

2.5

3-φ2.4±0.15

ACTIVE AREA

191.98×71.98

4-R3

R1

3.5

81.4±0.3

87.4±0.5

76.3±0.3(BEZEL OPENING AREA)

75(EFFECTIVE VIEWING AREA)

(38)(BEZEL OPENING AREA)

(EFFECTIVE VIEWING AREA)

2±0.1

2.8±0.3

58±0.3

50±0.3

24±0.3

4±0.1

4±0.5

0.3P

0.02

R G B

R G B R G

DOT SIZE

0.02

0.1P

3.5

φ2±0.1

4-R0.5

CENTER LINE(BEZEL OPENING AREA)

R1.2

2.2±0.1

3.25±1

19.2±0.15

20

1

3.5

3.3

22.7±0.3

②

70±5

216.3±1

113.9±0.3

2.2±0.3

222.4$^{+0.5}_{-1}$

①

※1.5±0.2

※4±0.2

6.7±0.3

Excluded the allowance of deformation

BEZEL/DISPLAY POSITION

ACTIVE AREA

BEZEL OPENING AREA

A

C

B

D

1) TOLERANCE X-DIRECTION    A:2.3±0.5

2) TOLERANCE Y-DIRECTION    B:2.3±0.5

3) OBLIQUITY OF DISPLAY AREA    IC-DI<0.5

① INTERFACE CONNECTOR

IL-FHR-20S-HF(JAE)相当品

<PIN LAYOUT>

| PIN# | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | YD | VSS | LP | VSS | XCK | VSS | DISP | VDD | VCON | VSS |
| PIN# | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | D0 | D1 | D2 | D3 | VSS | D4 | D5 | D6 | D7 | VDD |

指示なき寸法公差は ±0.5mm
UNSPECIFIED TOL TO BE

Fig. 16
名 称 NAME
LCD MODULE OUTLINE DIMENSIONS

記 号 SYMBOL

部品コード PARTS CODE

| 年 月 日 DATE | 改 定 記 事 RIVISE | 設通 No | 担 当 PREPA | 適 用 機 種 MODEL |
|---|---|---|---|---|

| 材 質 MATERIAL | 板 厚 THIKNESS | 仕 上 FINSH | 尺 度 SCALE |
|---|---|---|---|

| 設 計 DESIGN | 写 図 TRACE | 検 図 CHECK | 検 図 CHECK | 承 認 APPROVE |
|---|---|---|---|---|
| K.Horiuchi | | | | |

SHARP CORPORATION

シャープ株式会社 液晶奈良(事本)

発行部門 アューティー開発センター第2技術部

作成日付 DATE    1997・11・12・

図 番 DRAWING. No

**SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

# SHARP®

### NORTH AMERICA

SHARP Microelectronics of the Americas
5700 NW Pacific Rim Blvd.
Camas, WA 98607, U.S.A.
Phone: (1) 360-834-2500
Fax: (1) 360-834-8903
Fast Info: (1) 800-833-9437
www.sharpsma.com

### EUROPE

SHARP Microelectronics Europe
Division of Sharp Electronics (Europe) GmbH
Sonninstrasse 3
20097 Hamburg, Germany
Phone: (49) 40-2376-2286
Fax: (49) 40-2376-2232
www.sharpsme.com

### JAPAN

SHARP Corporation
Electronic Components & Devices
22-22 Nagaike-cho, Abeno-Ku
Osaka 545-8522, Japan
Phone: (81) 6-6621-1221
Fax: (81) 6117-725300/6117-725301
www.sharp-world.com

### TAIWAN

SHARP Electronic Components
(Taiwan) Corporation
8F-A, No. 16, Sec. 4, Nanking E. Rd.
Taipei, Taiwan, Republic of China
Phone: (886) 2-2577-7341
Fax: (886) 2-2577-7326/2-2577-7328

### SINGAPORE

SHARP Electronics (Singapore) PTE., Ltd.
438A, Alexandra Road, #05-01/02
Alexandra Technopark,
Singapore 119967
Phone: (65) 271-3566
Fax: (65) 271-3855

### KOREA

SHARP Electronic Components
(Korea) Corporation
RM 501 Geosung B/D, 541
Dohwa-dong, Mapo-ku
Seoul 121-701, Korea
Phone: (82) 2-711-5813 ~ 8
Fax: (82) 2-711-5819

### CHINA

SHARP Microelectronics of China
(Shanghai) Co., Ltd.
28 Xin Jin Qiao Road King Tower 16F
Pudong Shanghai, 201206 P.R. China
Phone: (86) 21-5854-7710/21-5834-6056
Fax: (86) 21-5854-4340/21-5834-6057
**Head Office:**
No. 360, Bashen Road,
Xin Development Bldg. 22
Waigaoqiao Free Trade Zone Shanghai
200131 P.R. China
Email: smc@china.global.sharp.co.jp

### HONG KONG

SHARP-ROXY (Hong Kong) Ltd.
3rd Business Division,
17/F, Admiralty Centre, Tower 1
18 Harcourt Road, Hong Kong
Phone: (852) 28229311
Fax: (852) 28660779
www.sharp.com.hk
**Shenzhen Representative Office:**
Room 13B1, Tower C,
Electronics Science & Technology Building
Shen Nan Zhong Road
Shenzhen, P.R. China
Phone: (86) 755-3273731
Fax: (86) 755-3273735