# SHARP

# LM094YS1T64
## Color STN LCD Module

(Model Number: LM094YS1T64)

## Specifications

Spec No.: LC00Z07

Dated: May 31. 2002

# SHARP

LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

## SPECIFICATION

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DEVICE SPECIFICATION for
Passive Matrix Color LCD Module
(800 × 480 dots)

Model No.

# LM094YS1T64

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☐CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY _____ *M. Ise* _____
M.Ise
DIVISION GENERAL MANAGER
DUTY LCD DEVELOPMENT CENTER
DUTY LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

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○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 table 　)

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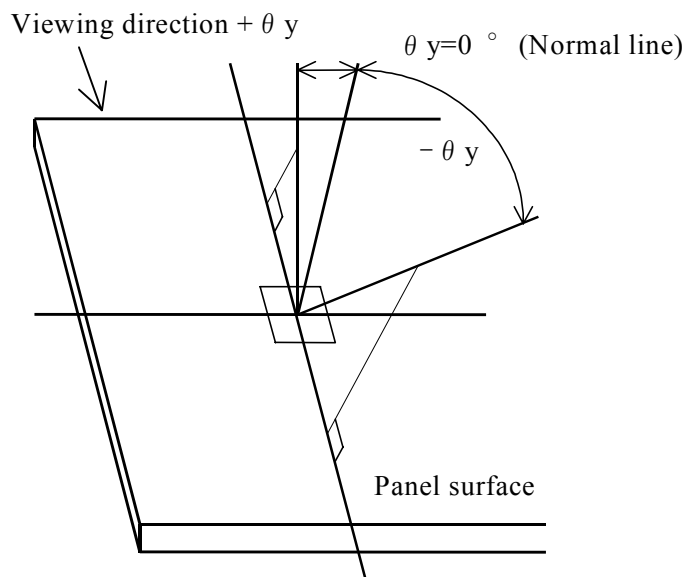


Fig.1 Definition of viewing angle

2)　This module should be installed using mounting holes of metal bezel.

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(electrostatic earth:$1 \times 10^8 \Omega$) 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 polarizer 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 on horizontal firm base.

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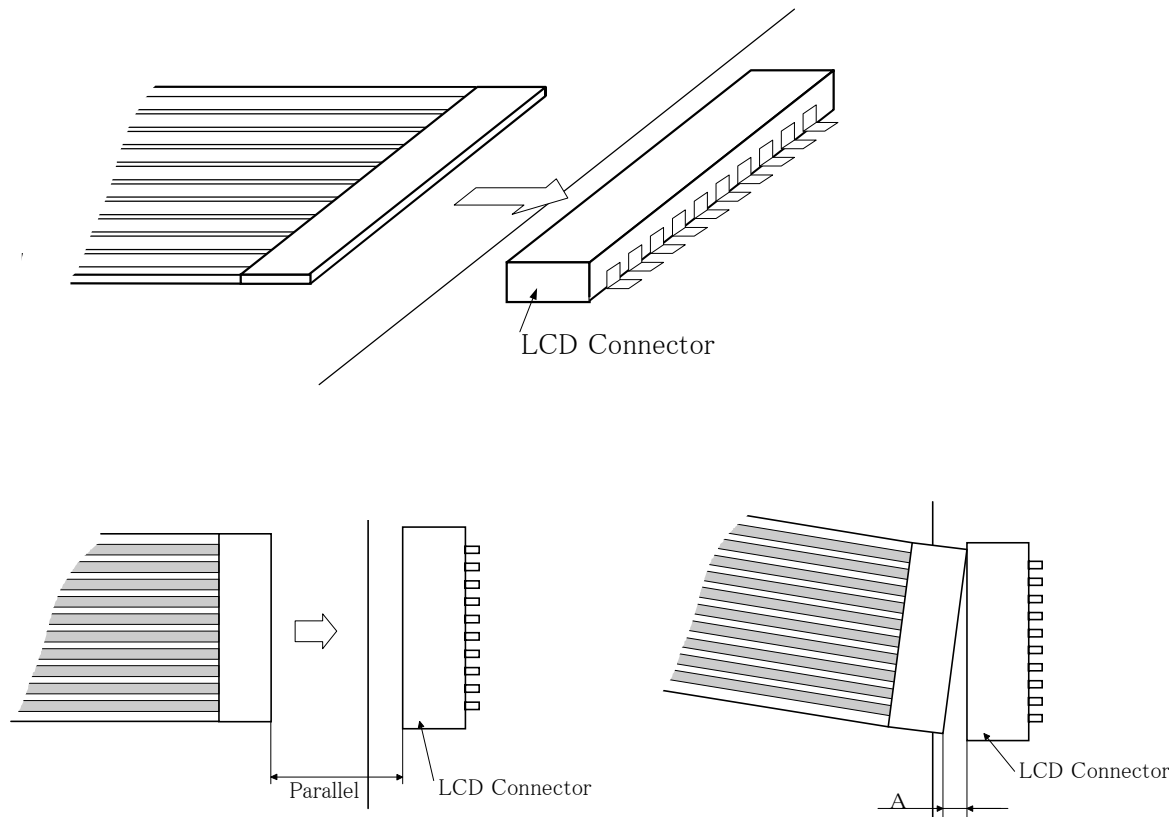
14) This specification describes display quality in case of no gray scale. Since display quality can be affected by gray scale methods, display quality shall be carefully evaluated for the usability of LCD module in case gray scale is displayed on the LCD module.

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. <u>Especially the power ON/OFF sequence shown on Page 26 should be kept to avoid latch-up of drive LSI and application of DC voltage to LCD panel</u>

16) It is a characteristic of LCD to maintain the displaying pattern when the pattern is applied for a long time.(Image retention)
To prevent image retention, please do not apply the fixed pattern for along time by pre-installing such programs at your side.

17) This phenomena (image retention) is not deterioration of LCD. If it happens, you can remove it by applying different patterns.

18) CCFT backlight should be kept OFF during VDD is "L" level.

WARNING

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

○Contents                                                                                                    Page

1.Application

This data sheet is to introduce the specification of LM094YS1T64, passive Matrix type Color LCD module.


2.Construction and Outline

Construction: 800×480 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.
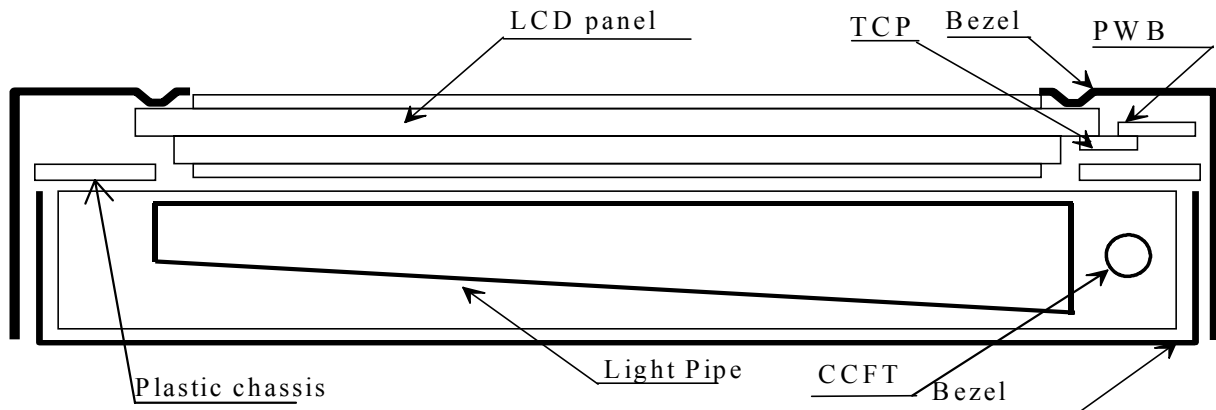


Outline        :See Fig. 14
Connection    :See Fig. 14 and Table 6

3.Mechanical Specification

Table1

| Parameter | Specifications | Unit |
| --- | --- | --- |
| Outline dimensions | 236.8±0.5(W)×142.3±0.5(H)×8.5MAX(D) | mm |
| Effective viewing area | 207(W)×125.4(H) | mm |
| Display format | 800(W)×480(H) | mm |
| Dot size | 0.065×RGB(W)×0.235(H) | - |
| Dot spacing | 0.02 | mm |
| *1    Base color | Normally black    *2 | - |
| Weight | 305 | 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 | 4.5 | 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～57 Hz | 57 Hz～500 Hz |
|---|---|---|
| Vibration level | - | 9.8 m/s$^2$ |
| Vibration width | 0.075 mm | - |
| Interval | 10 Hz～500 Hz～10 Hz/11.0 min | |

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

Note 3)   Accerelation   :   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±0.3V　1/tFRM=72 Hz　(Note 3)

| 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～ | $0.8V_{DD}$ | - | $V_{DD}$ | V |
| | | "L" level | 40 ℃ | 0 | - | $0.2V_{DD}$ | V |
| Supply current | $I_{DD}$(TYP.) | Ta =25 ℃(Note 1,2) | | - | 75 | 120 | mA |
| | $I_{DD}$(MAX.) | Ta =25 ℃(Note 1,3) | | - | 125 | 190 | mA |
| Rush current (Logic) | Irush | Ta =25 ℃ (Note 1) | | 1.0 A(pk)×30 ms | | | |
| Ripple current (Logic) | Irip | Ta =25 ℃ (Note 1) | | 0.5 A(pk)×40 μ s | | | |
| Power consumption | Pd(TYP.) | Note 2) | | - | 248 | 396 | mW |
| | Pd(MAX.) | Note 3) | | - | 413 | 627 | mW |

Note 1) Under the following conditions.;

　　① Immediately after the rise of $V_{DD}$ .　　　　　　　　　: 1.0 A(pk)×30 ms

　　② Under the situation that DISP signal is on and kept steady　: 0.5 A(pk)×40 μ s

Note 2) Frame Frequency = 72 Hz , Vcon - Vss = 1.95 V

　　Display pattern = all digits ON (DU0-7 = "H" )

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Note 3) Frame Frequency = 72 Hz , Vcon - Vss = 1.95 V

　　Display pattern = Checker pattern

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Note 4) The shadowing is adjusted on this module to the following conditions. When LCD module is operated

　　in the other conditions, that should be informed in advance because display quality may be deteriorated

　　in this case.

　　　<u>Frame frequency : 72 Hz</u>

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

LCD driving voltage "$V_{LCD}$" is adjusted automatically according to the change of ambient temperature range by the temperature compensation circuit.

Temperature compensation circuit built in LCD module have been set obtain the optimum contrast under following driving conditions.;

Take care that voltage for optimum contrast is changed under the different condition.

Frame frequency : 72 Hz, Duty ratio : 1/487, Ta = 25 ℃

※The above is the condition of the module setting, not the electrical characteristics.

DC/DC Converter
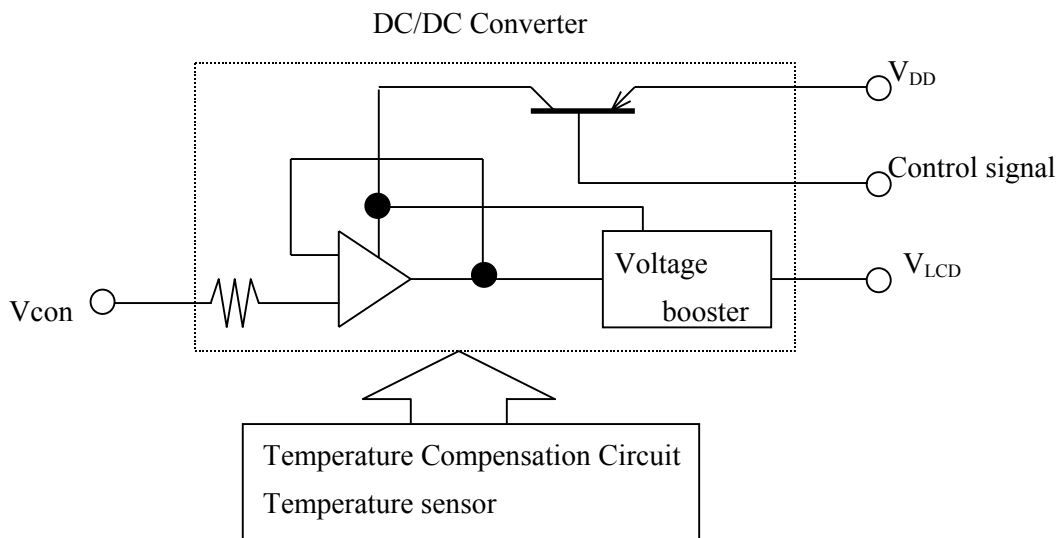
5-2.Interface signals

○LCD                                    Table 6

| Pin No. | Symbol | Description | Level |
|---|---|---|---|
| 1 | VSS | Ground potential | - |
| 2 | VSS | Ground potential | - |
| 3 | DU7 | Display data signal | H(ON), L(OFF) |
| 4 | DU6 | Display data signal | H(ON), L(OFF) |
| 5 | DU5 | Display data signal | H(ON), L(OFF) |
| 6 | DU4 | Display data signal | H(ON), L(OFF) |
| 7 | DU3 | Display data signal | H(ON), L(OFF) |
| 8 | DU2 | Display data signal | H(ON), L(OFF) |
| 9 | DU1 | Display data signal | H(ON), L(OFF) |
| 10 | DU0 | Display data signal | H(ON), L(OFF) |
| 11 | VSS | Ground potential | - |
| 12 | VSS | Ground potential | - |
| 13 | VDD | Power supply for logic and LCD | - |
| 14 | VDD | Power supply for logic and LCD | - |
| 15 | VDD | Power supply for logic and LCD | - |
| 16 | DISP | Display control signal | H(ON), L(OFF) |
| 17 | Vcon | Contrast adjust voltage | - |
| 18 | VSS | Ground potential | - |
| 19 | XCK | Data input clock signal | "H" → "L" |
| 20 | LP | Input data latch signal | "H" → "L" |
| 21 | YD | Scan start-up signal | "H" |
| 22 | VSS | Ground potential | - |

○CCFT

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

○LCD

   Used            connector : XF2H-2215-1(OMRON)

   Correspondable connector : FPC/FFC(0.5 mm Pitch×22)

○CCFT

   Used            connector : BHR-03VS-1       (JST)

   Correspondable connector : SM02(8.0)B-BHS(JST)

   Except above connector shall be out of guaranty.
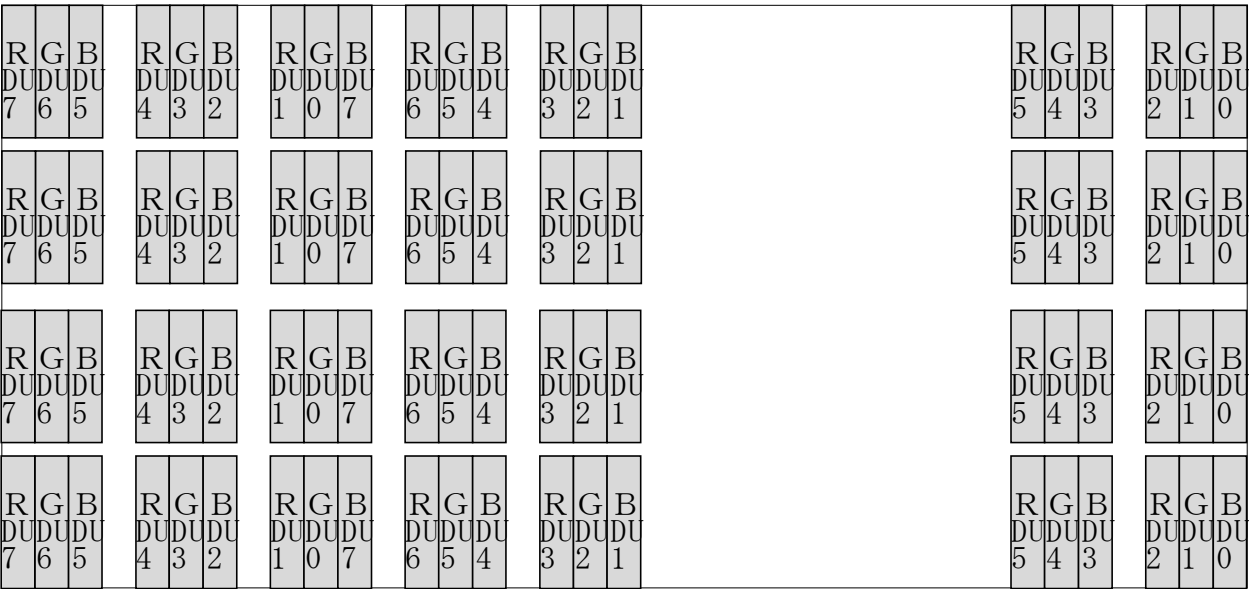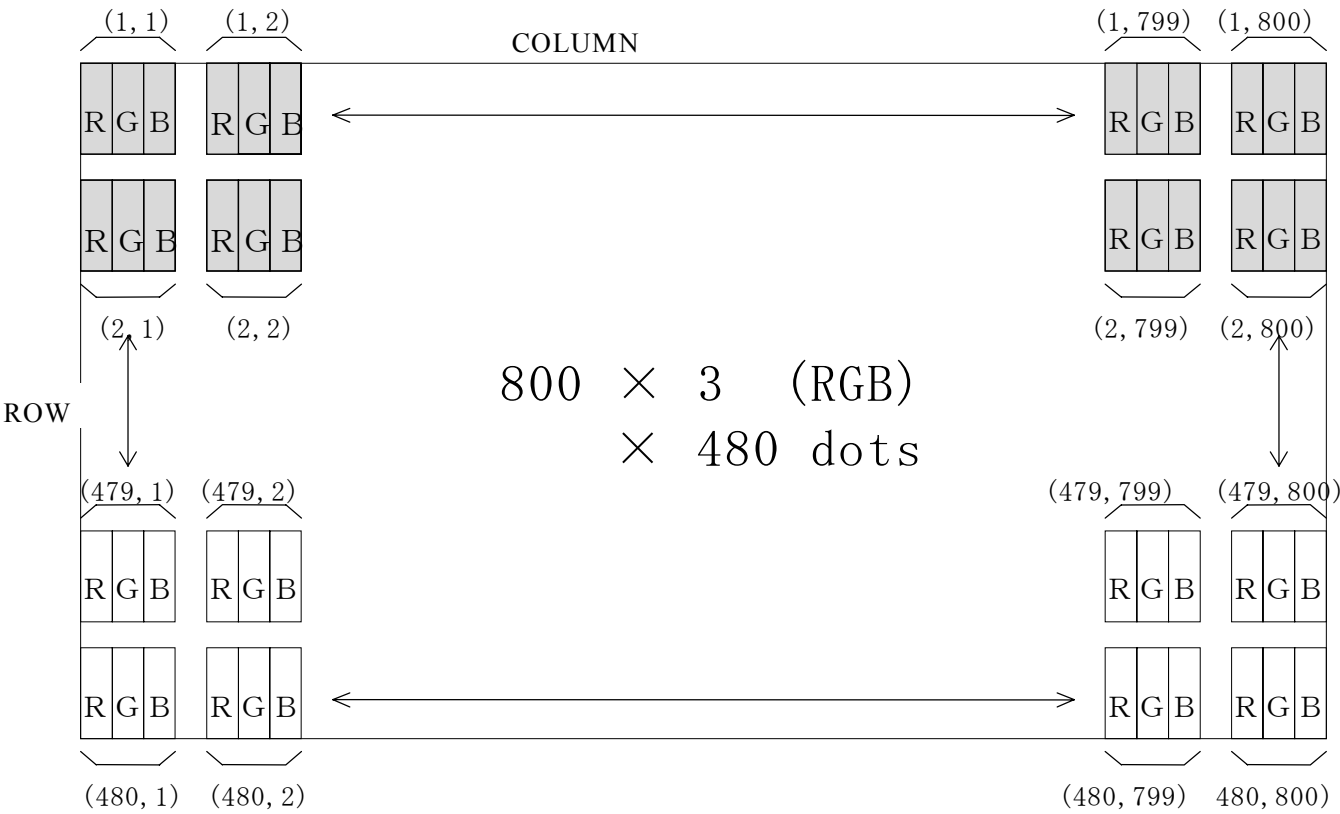
Fig.2 Dot chart of display area

LP×(487) pulses *

YD

LP

DU0
～
DU7

1st line's display data | 2nd line's display data | 487th line's display data | 1st line's display data | 2nd line's display data

XCK × 800 × (3/8) pulses

LP

XCK

XCK

| | | | | | | |
|---|---|---|---|---|---|---|
| DU7 | R(1,1) | B(1,3) | G(1,6) | R(1,9) | B(1,11) | G(1,14) |
| DU6 | G(1,1) | R(1,4) | B(1,6) | G(1,9) | R(1,12) | B(1,14) |
| DU5 | B(1,1) | G(1,4) | R(1,7) | B(1,9) | G(1,12) | R(1,15) |
| DU4 | R(1,2) | B(1,4) | G(1,7) | R(1,10) | B(1,12) | G(1,15) |
| DU3 | G(1,2) | R(1,5) | B(1,7) | G(1,10) | R(1,13) | B(1,15) |
| DU2 | B(1,2) | G(1,5) | R(1,8) | B(1,10) | G(1,13) | R(1,16) |
| DU1 | R(1,3) | B(1,5) | G(1,8) | R(1,11) | B(1,13) | G(1,16) |
| DU0 | 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. 3    Data input timing chart

Fig.4 Interface timing chart

(NOTE 1)    In order to keep operating LCD display during "A" period, DISP signal should be "H" level so that $V_{IH}(0.8V_{DD})$ do not break into the line.        $t_{DISPX} = 0$ ns Max.

<u>Table 7 Interface timing ratings</u>

Ta=0~40 ℃,VDD=3.3±0.3V

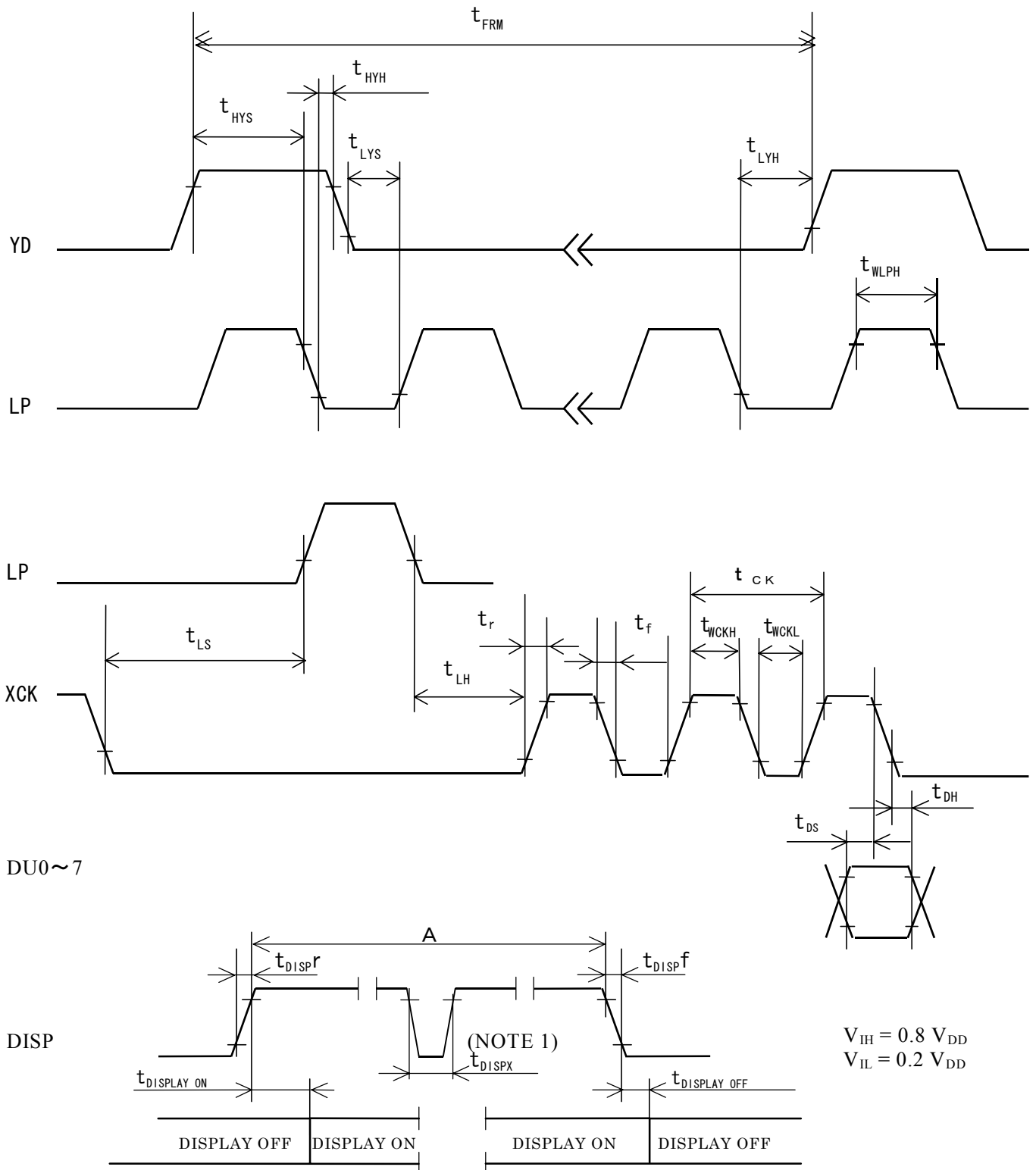| Item | Symbol | Rating | | | Unit |
|---|---|---|---|---|---|
| | | MIN. | TYP. | MAX. | |
| Frame cycle *2 | $t_{FRM}$ | 8.33 | | 16.94 | ms |
| XCK signal clock cycle | $T_{CK}$ | 50 | | | ns |
| "H" level clock width | $t_{WCKH}$ | 20 | | | ns |
| "L" level clock width | $t_{WCKL}$ | 19 | | | ns |
| LP signal clock cycle | $T_{LP}$ | | | 70 | $\mu$ s |
| LP signal "H" level pulse width | $t_{WLPH}$ | 200 | | | ns |
| Data set up time | $T_{DS}$ | 16 | | | ns |
| hold time | $T_{DH}$ | 20 | | | ns |
| YD signal "H" level set up time | $t_{HYS}$ | 100 | | | ns |
| "H" level hold time | $t_{HYH}$ | 100 | | | ns |
| "L" level set up time | $t_{LYS}$ | 100 | | | ns |
| "L" level hold time | $t_{LYH}$ | 40 | | | ns |
| LP↑ allowance time from XCK↓ | $T_{LS}$ | 200 | | | ns |
| XCK↑ allowance time from LP↓ | $T_{LH}$ | 200 | | | ns |
| Input signal rise/fall time *1 | $T_r,t_f$ | | | 13 | ns |
| DISP signal rise/fall time | $t_{DISP}r, t_{DISP}f$ | | | 100 | ns |
| DISPLAY ON from DISP↑ | $t_{DISPLAY\ ON}$ | | | 350 | ms |
| DISPLAY OFF from DISP↓ | $t_{DISPLAY\ OFF}$ | | | 150 | ms |

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

*2   As for the specification of frame cycle, it is required to keep the conditions of the other Interface timing ratings.
   The shadowing is adjusted on this module to the following conditions. When LCD module is operated
   in the other conditions, that should be informed in advance because display quality may be deteriorated
   in this case.

   <u>Frame frequency : 72 Hz(Frame cycle : 13.89 ms)</u>

   Owing to the characteristics of LCD module, "shadowing" will become more eminent as frame frequency goes
   up, while flicker will be reduced.

   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

※   <u>The intervals of one LP fall and next must be always the same, and LPs must be input continuously.</u>
   <u>The intervals must be 70 $\mu$ s Max</u>

6. Module Driving Method

6-1. Circuit configuration

Fig.10 shows the block diagram of the module's circuitry.

6-2. Display face configuration

The display consists of $800 \times 3$(R,G,B)$\times 480$ dots as shown in Fig. 2.

The interface is single panel to be driven at 1/487duty 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 row ($800 \times 3$ 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 ($800 \times 3$ 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 $800 \times 3$ 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 $800 \times 3$ dots have been transferred, 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 487 th row of 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 DU0-7.

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. 4 and Table 8.

7.Optical Characteristics

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

Table 8      Ta = 25 ℃,   $V_{DD}$= 3.3 V,   Vcon-$V_{SS}$ = Vmax

| Parameter | | Symbol | Condition | | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Viewing angle range | | $\theta x$ | Co>5.0 | $\theta y = 0°$ | -30 | - | 30 | | Note 1) |
| | | $\theta y$ | | $\theta x = 0°$ | -20 | - | 10 | | |
| Contrast ratio | | Co | $\theta x = \theta y = 0°$ | | - | 30 | - | - | Note2) |
| Response time | Rise | $\tau r$ | $\theta x = \theta y = 0°$ | | - | 300 | - | ms | Note3) |
| | Decay | $\tau d$ | $\theta x = \theta y = 0°$ | | - | 150 | - | ms | |
| Module Chromaticit | White | x | $\theta x = \theta y = 0°$ | | - | 0.285 | - | - | |
| | | y | $\theta x = \theta y = 0°$ | | - | 0.305 | - | - | |

Note 1)   The viewing angle range is defined as shown Fig.5.
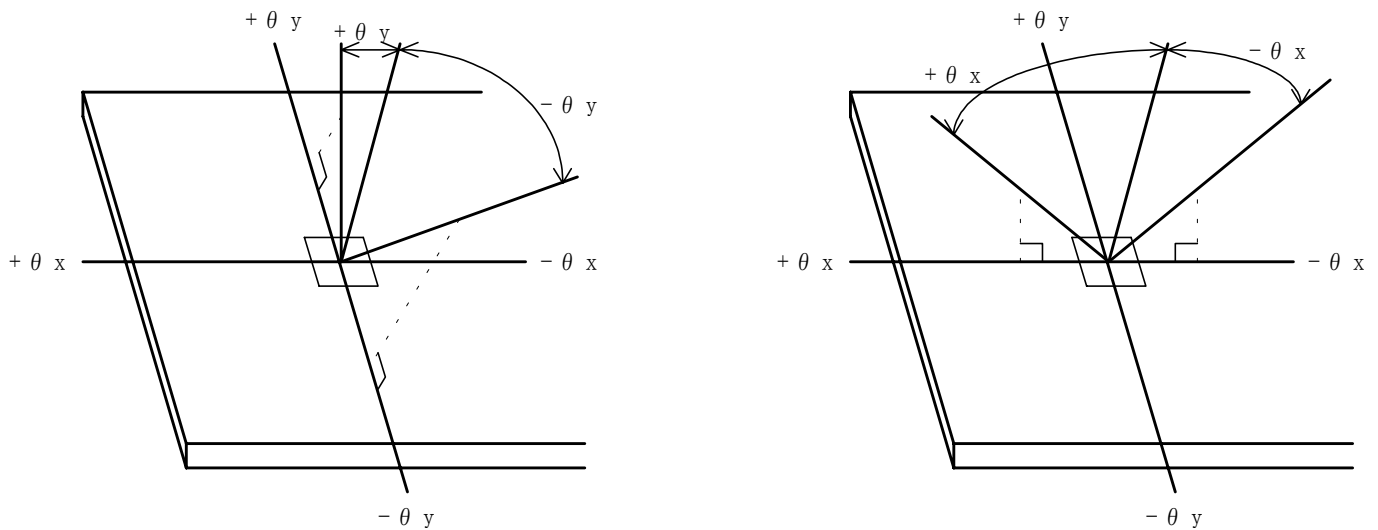


Fig.5   Definition of Viewing Angle

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.7.

Note 3)   The response characteristics of photo-detector output are measured as shown in Fig.8, 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.9.
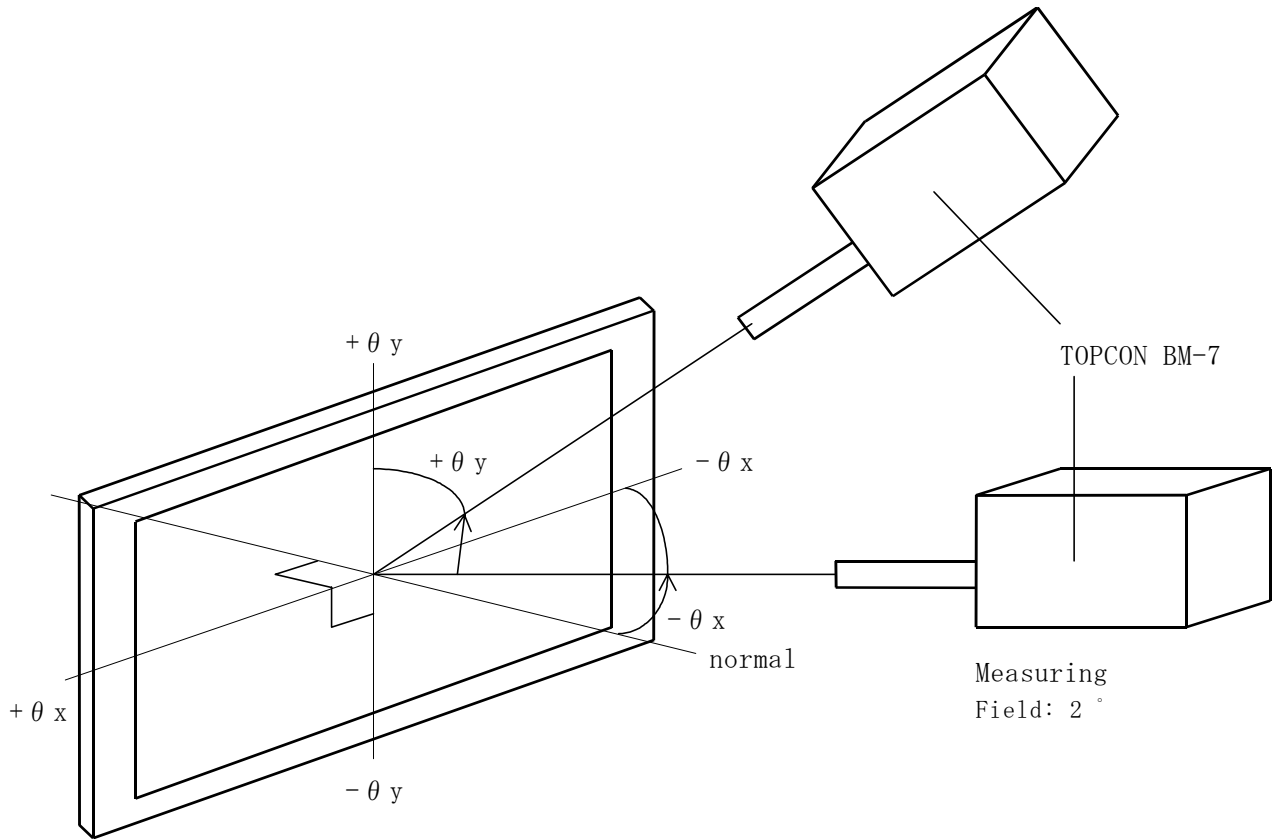
Measuring Spot Size : $\phi$ 10 mm

$\theta$ 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.6 Optical Characteristics Test Method Ⅰ



Fig.7 Definition of Vmax

(Response Measurement)

Ta = 25 ℃

In dark room



$\theta$ y(+)

85 mm

$\theta$ x(-)

Computer

LCD Control circuit

LCD Module

$\theta$ x(+)

$\theta$ y(-)

A/D Converter

normal

$\theta$ x= $\theta$ y= 0°

TOPCON BM7 + quartz fiber

(Measuring spot size : $\phi$ 10 mm, Measuring Field : 2 ° )

Fig. 8 Optical Characteristics Test Method Ⅱ

[Drive waveform]

1/487 Duty Ratio

Driving voltage

Non-select waveform — Select waveform — Non-select waveform

[Responce waveform]

Photo detector output

90 %

10 %

$\tau$ r

90 %

10 %

$\tau$ d

$\tau$ r : Rise time

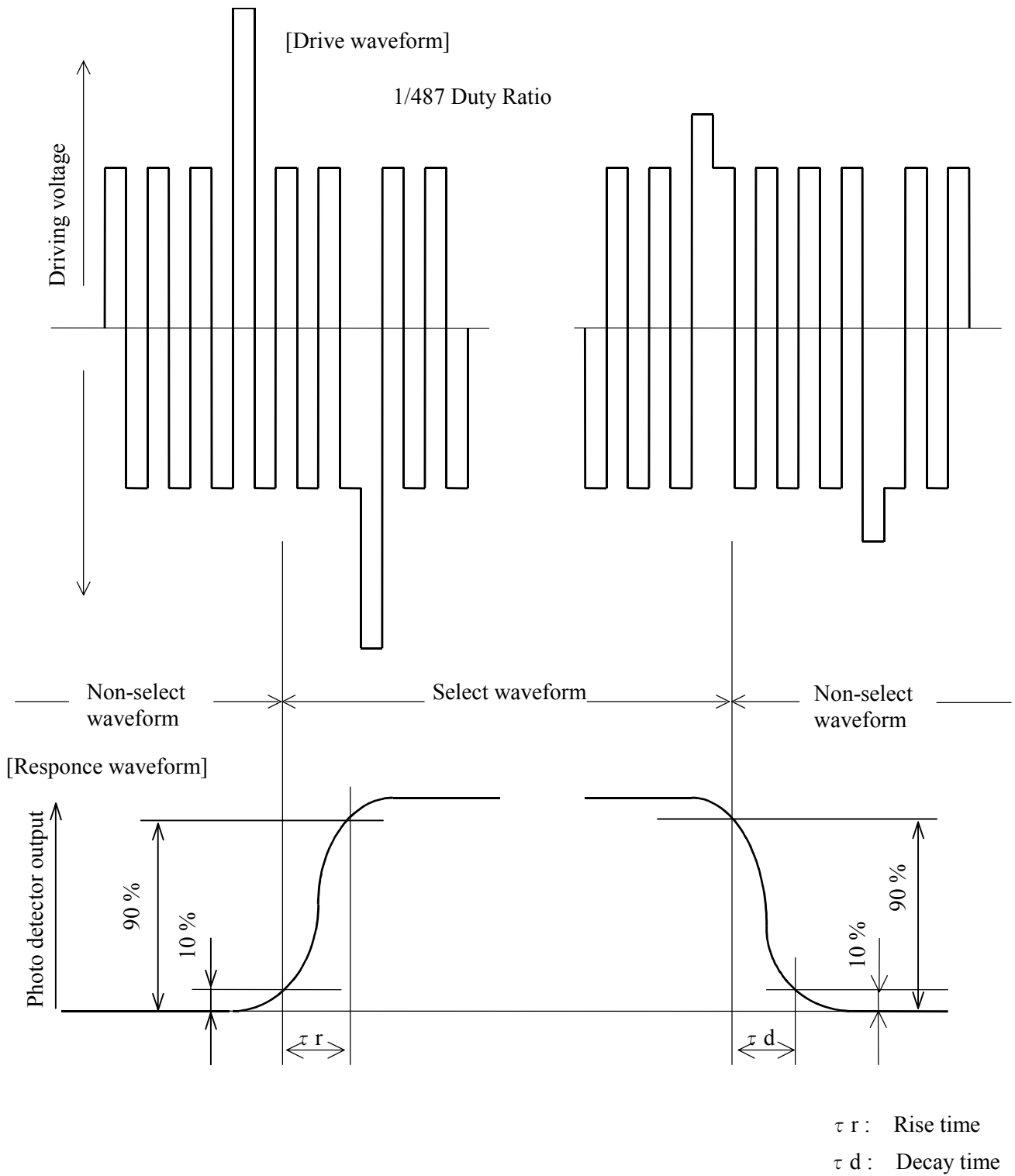$\tau$ d : Decay time
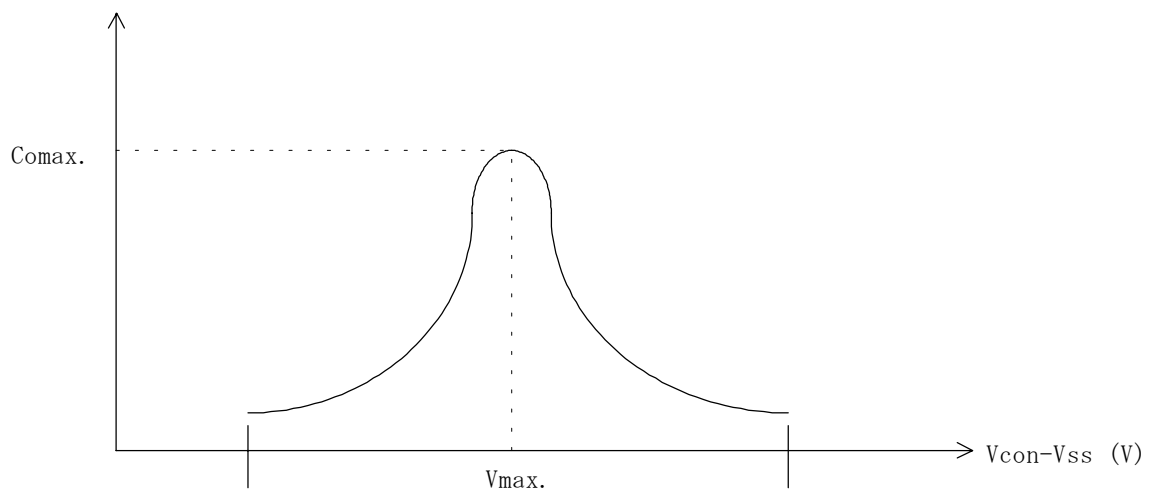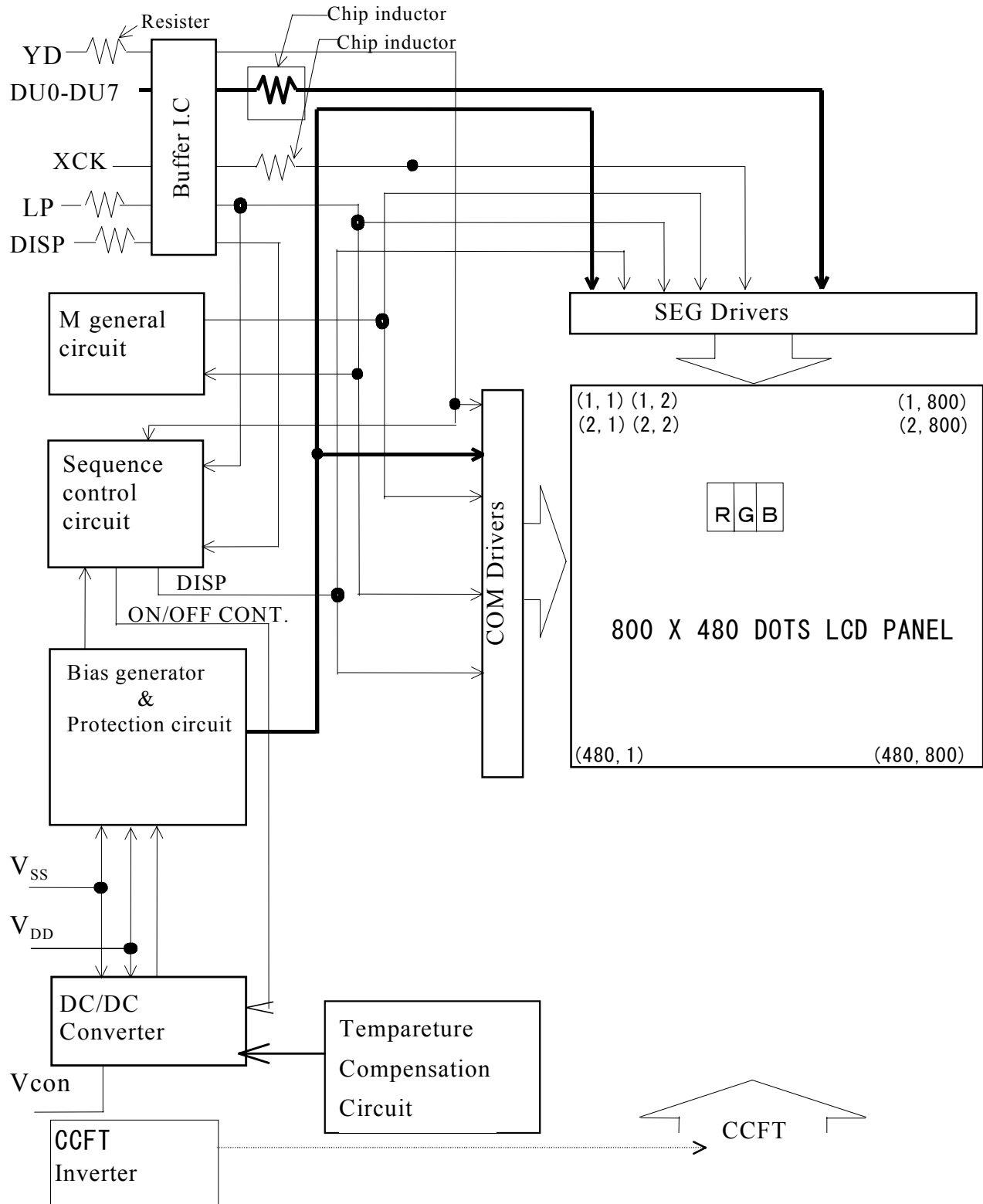
Fig.9 Definition of Response time

Fig. 10 Circuit block diagram

8.Characteristics of Backlight

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

1) Rating(Note)

| Parameter | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|
| Brightness | 75 | 100 | - | cd/m$^2$ |

2) Measurement circuit : CXA-L0612-VJL(TDK) at IL = 5.5 mArms

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

4) Measurement conditions

4-1. Measurement circuit voltage : DC = 12.0 V, at primary side

4-2. LCD: All digits WHITE, VDD= 3.3 V, Vcon-VSS = Vmax, DU0-7="H"(White),

Frame Frequency 72 Hz

4-3. Ambient temperature : 25 ℃

Measurement shall be executed 30 minutes after turning on.

5) Used lamp : MBVK2J( )X216.5NLH/G (HARISON TOSHIBA LIGHTING Corp.)

Used cable : UL3587, AWG26 (NISSEI ELECTRIC CO.,LTD.)

UL1430, AWG26 (SUMITOMO ELECTRIC INDUSTRIES LTD.)

5-1. Rating (1pc)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit | Remark |
|---|---|---|---|---|---|---|
| Lamp voltage | $V_L$ | - | 530 | - | Vrms | - |
| Lamp current | $I_L$ | - | 5.5 | 6.0 | mArms | *1 |
| Lamp power consumption | $P_L$ | - | 2.92 | - | W | *2 |
| Lamp frequency | $F_L$ | 30 | - | 80 | kHz | - |
| Kick-off voltage | $V_S$ | - | - | 850 | Vrms | Ta=25 ℃ |
| | | - | - | 1050 | Vrms | Ta= 0 ℃ |
| Lamp life time | $L_L$ | 15 000 | 25000 | - | H | - |

Within no conductor closed. (CCFT only)

*1 It is recommended that IL be not more than 6.0 mArms 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 temperature.

5-2. Operating life

The operating life tome is 15 000 hours or more at 6.0 mArms MAX., at 25℃. (Operating life with
CXA-L0612-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:    30 kHz - 80 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; $25 \pm 1$ ℃
-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.11.
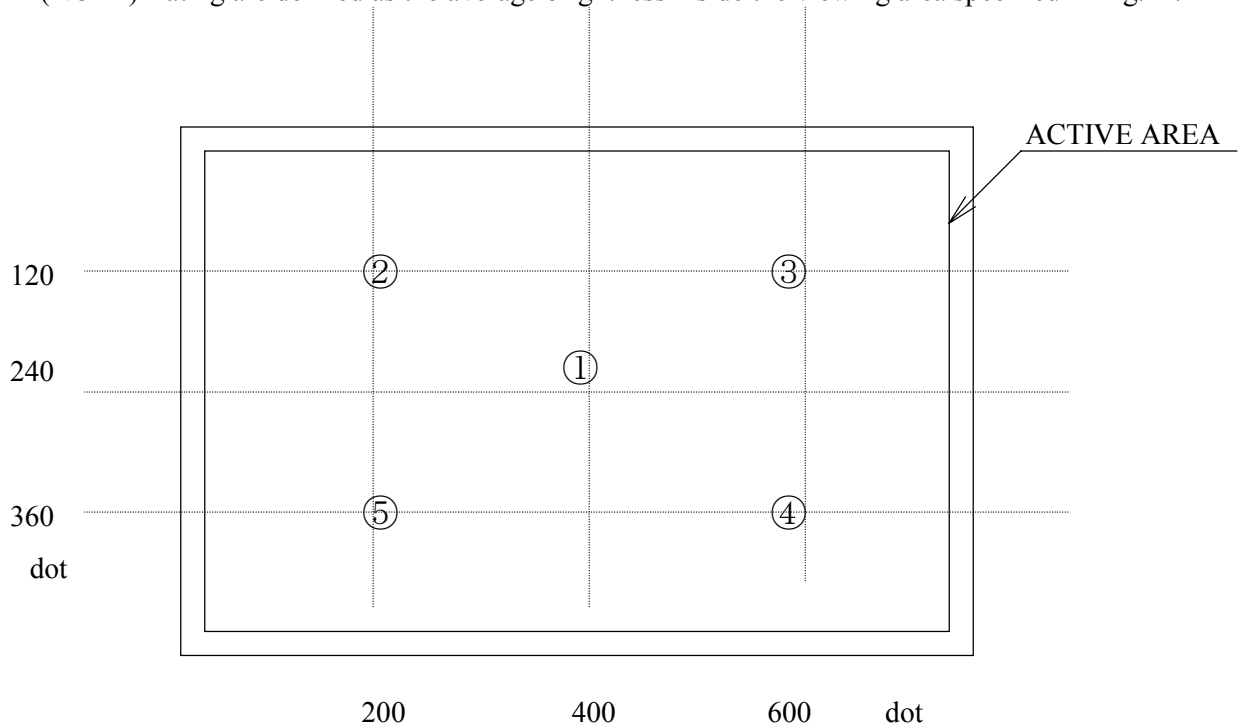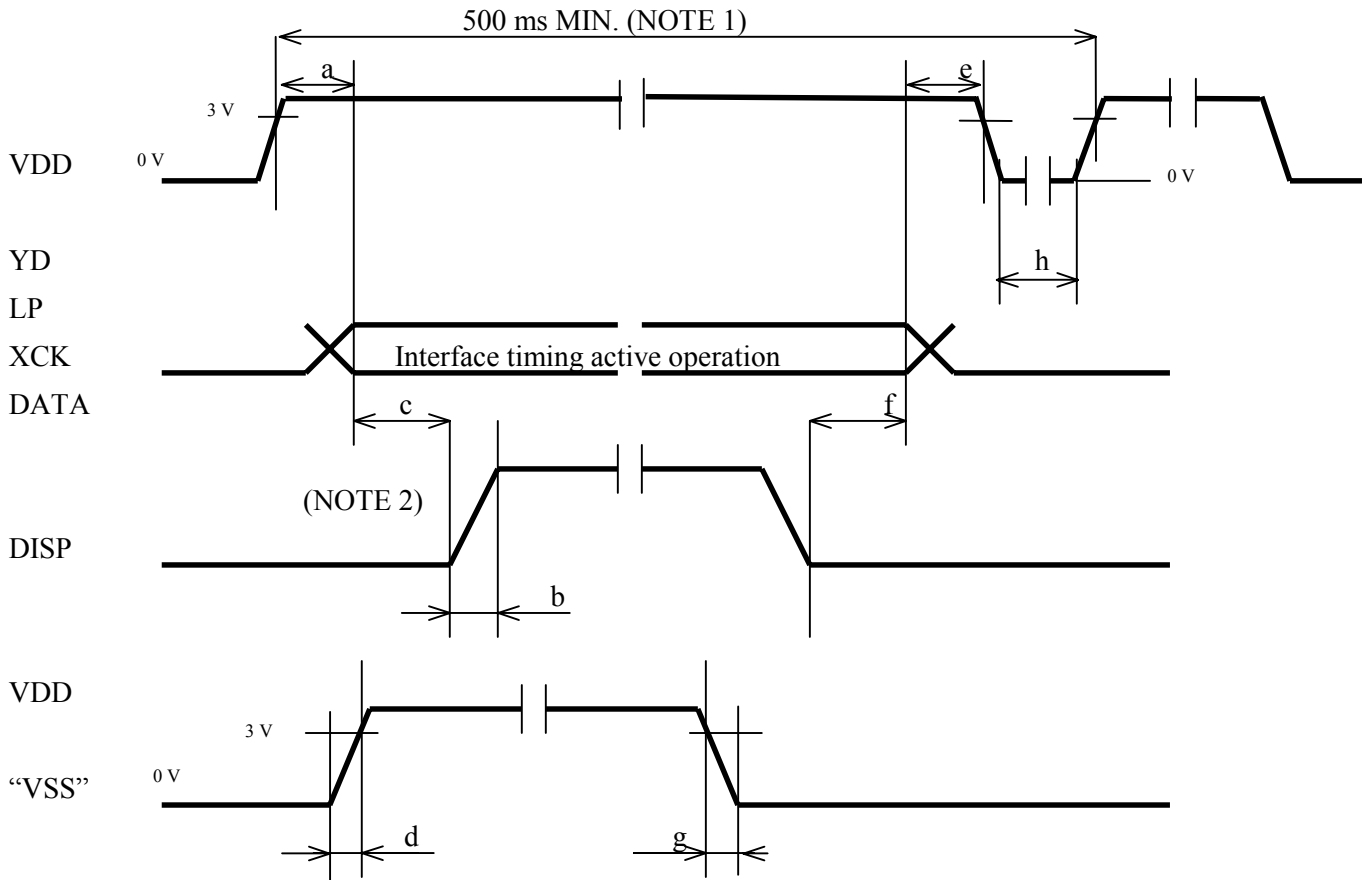


Fig.11 Measuring points (1-5)

9.ON/OFF 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. | － |
| g | 2ms MIN. | 250 ms MAX. |
| h | 250 ms MIN. | － |

Fig.12 Supply voltage sequence condition

(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 must be input, and the above condition of "a" must be satisfied. The signals which comply with the interface timing in Fig.3,Fig.4, and table 6, must be input.

10.Applicable inspection standard

     The LCD module shall meet the following inspection standard :   S-U-035-08


11.Lot Number

  Lot number is shown at the position mentioned in Fig.13 in accordance with the following numbering rule.
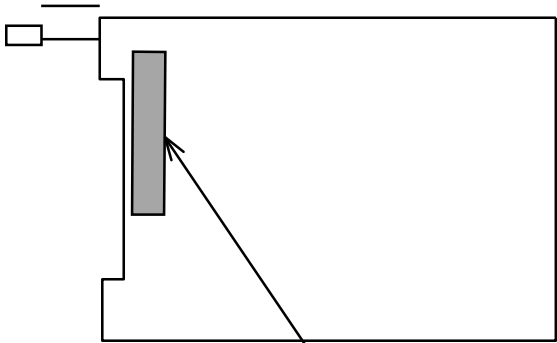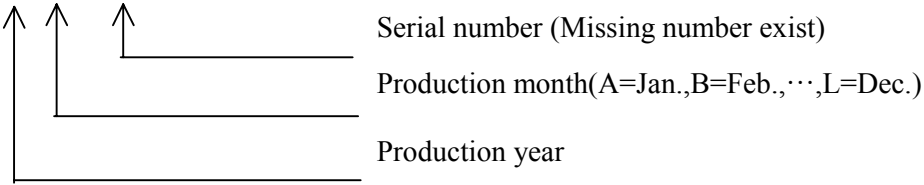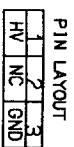
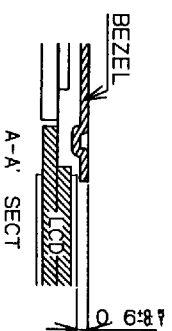   (Example)   <u>00</u> <u>D</u> <u>00001</u>

                  Serial number (Missing number exist)

                  Production month(A=Jan.,B=Feb.,···,L=Dec.)

                  Production year

Fig.13     Model and Serial number

800×RGB×480DOTS

ACTIVE AREA
203.98×122.38
EFFECTIVE VIEWING AREA
207×125.4

142.3±0.5
134.9±0.3
126.4±0.3
67.45±0.3
3±0.15

236.8±0.5
231.4±0.3
208±0.3
110.8±0.3
50±5
2.9

2-R1.5±0.15
2-R3
2.1±1

0.255P
0.235
0.02

| R | G | B | R | G | B |
| R | G | B | R | G | B |

0.02
0.065
0.085P

4.9±0.2
2±0.2
3min

8.0±0.5
4.9±0.2
2.2±0.2
3min
3min(4PL)

FREE SPACE AREA FOR SCREW BOSS

Excluded the allowance of deformation
This value shows the thickness after mounting
and fixing to customer's cabinet.

CENTER LINE(BEZEL OPENING AREA)

BEZEL/DISPLAY POSITION
Bezel Opening Area
Active Area

1) TOLERANCE X-DIRECTION    A:2.0±0.5
2) TOLERANCE X-DIRECTION    B:2.0±0.5
3) OBLIQUITY OF DISPLAY AREA |C-D|<0.5

C
B
D
A

2-R3min

4-R0.5

2-0_15(hole)
3
93.9±0.3
45.2±0.3
51.2±0.3
105.9±0.3
2±0.3
3min
4
2-⌀3±0.15(hole)
⌀2-0_15(hole)

2.2±0.2
4.9±0.2
3min

UL3587 AWG#26 or UL1430 AWG#26
UL3587 AWG#26

CCFT CONNECTO
BHR-03VS-1(JST)
PIN LAYOUT

| 1 | 2 | 3 |
|---|---|---|
| HV | NC | GND |

① INTERFACE CONNECTOR
XF2H-2215-1(OMRON)

| Pin No. | Symbol | Pin No. | Symbol |
|---|---|---|---|
| 1 | VSS | 12 | VSS |
| 2 | VSS | 13 | VDD |
| 3 | DU7 | 14 | VDD |
| 4 | DU6 | 15 | VDD |
| 5 | DU5 | 16 | DISP |
| 6 | DU4 | 17 | Vcon |
| 7 | DU3 | 18 | VSS |
| 8 | DU2 | 19 | XCK |
| 9 | DU1 | 20 | LP |
| 10 | DU0 | 21 | YD |
| 11 | VSS | 22 | VSS |

A-A' SECT
BEZEL
LCD
0.6±1

Unspecified tol to be ±0.5mm

| DESIGN | TRACE | | | | |
|---|---|---|---|---|---|
| CHECK | CHECK | APPROVE | | | |

MATERIAL
DATE
REVISE
THICKNESS
FINISH
PREPA
SCALE
MODEL LM094YS1T64
SYMBOL 800×RGB×480
PARTS CODE
DATE 2000.11.7
DRAWING No.

NAME
LCD MODULE OUTLINE DIMENSIONS

SHARP CORPORATION
ENGINEERING DEPARTMENT 1
DUTY LCD DEVELOPMENT CENTER
DUTY LIQUID CRYSTAL DISPLAY GROUP

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

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