

## LQ150X1LG71 LCD Module

### Product Specification

October 2007

XGA LCD Module featuring 250 nits  
brightness with 550:1 contrast.  
Full Specifications Listing

**SHARP**<sup>®</sup>

|                        |  |                                     |
|------------------------|--|-------------------------------------|
| PREPARED BY :     DATE | <b>SHARP</b>   | SPEC No. LD-19918A                  |
| APPROVED BY :     DATE |  | FILE No.                            |
|                        |  | ISSUE : Oct. 5. 2007                |
|                        |  | PAGE : 23 pages                     |
|                        | MOBILE LIQUID CRYSTAL DISPLAY GROUP<br>SHARP CORPORATION | APPLICABLE GROUP                    |
|                        | <b>SPECIFICATION</b>                                     | MOBILE LIQUID CRYSTAL DISPLAY GROUP |

DEVICE SPECIFICATION FOR

# TFT-LCD Module

MODEL No.

## LQ150X1LG71

**These parts have corresponded with the RoHS directive.**

CUSTOMER'S APPROVAL  
BY \_\_\_\_\_

BY           *K. Shiono*          

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SHARP CORPORATION



## 1. Application

This specification applies to the color 15.0 XGA TFT-LCD module LQ150X1LG71.

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The device listed in these specification sheets was designed and manufactured for use in general electronic equipment.

In case of using the device for applications such as control and safety equipment for transportation (controls of aircraft, trains, automobiles, etc.), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

SHARP assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specification sheets.

Confirm "11. Handling Precautions " item when you use the device.

Contact and consult with a SHARP sales representative for any questions about this device.

## 2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit and a back light unit. Graphics and texts can be displayed on a 1024 × RGB × 768 dots panel with about 16 million colors by using LVDS (Low Voltage Differential Signaling) and supplying +3.3V DC supply voltages for TFT-LCD panel driving and supply voltage for backlight. Backlight-driving DC/AC inverter is not built in this module. Viewing angle is 6 o'clock direction.

## 3. Mechanical Specifications

| Parameter                  | Specifications                                      | Unit  |
|----------------------------|---|-------|
| Display size               | 38 (Diagonal)                                       | cm    |
|                            | 15.0 (Diagonal)                                     | Inch  |
| Active area                | 304.1 (H) × 228.1 (V)                               | mm    |
| Pixel format               | 1024 (H) × 768 (V)                                  | Pixel |
|                            | (1 pixel = R+G+B dots)                              |       |
| Pixel pitch                | 0.297 (H) × 0.297 (V)                               | mm    |
| Pixel configuration        | R, G, B vertical stripe                             |       |
| Display mode               | Normally white                                      |       |
| Unit outline dimensions *1 | 326.0(W) × 252.0(H) × 11.2(D)                       | mm    |
| Mass                       | 1000 Max.   | g     |
| Surface treatment          | Anti-glare and hard-coating 3H<br>(Haze value = 25) |       |

\*1.Note: excluding back light cables, cover and pet sheet.

The thickness of module (D) doesn't contain the projection.

Outline dimensions are shown in Fig.1.

## 4. Input Terminals

## 4-1. TFT-LCD panel driving

CN1 (Interface signals and +3.3V DC power supply)

Using connectors : DF14H-20P-1.25H (Hirose Electric Co., Ltd.)

Corresponding connectors : DF14-20S-1.25C(Hirose Electric Co., Ltd.)

( ) Please do not use it besides corresponding connector

| Pin No. | Symbol   | Function                                       | Remark            |
|---------|----------|--|-------------------|
| 1       | Vcc      | +3.3V Power supply                             |                   |
| 2       | Vcc      | +3.3V Power supply                             |                   |
| 3       | GND      |  |                   |
| 4       | GND      |  |                   |
| 5       | RXIN0-   | Receiver signal (-)                            | LVDS              |
| 6       | RXIN0+   | Receiver signal (+)                            | LVDS              |
| 7       | GND      |  |                   |
| 8       | RXIN1-   | Receiver signal (-)                            | LVDS              |
| 9       | RXIN1+   | Receiver signal (+)                            | LVDS              |
| 10      | GND      |  |                   |
| 11      | RXIN2-   | Receiver signal (-)                            | LVDS              |
| 12      | RXIN2+   | Receiver signal (+)                            | LVDS              |
| 13      | GND      |  |                   |
| 14      | RXCKIN-  | Clock signal (-)                               | LVDS              |
| 15      | RXCKIN+  | Clock signal (+)                               | LVDS              |
| 16      | GND      |  |                   |
| 17      | RXIN3-   | Receiver signal (-)                            | LVDS              |
| 18      | RXIN3+   | Receiver signal (+)                            | LVDS              |
| 19      | HANTEN   | Horizontal/Vertical display mode select signal | 【note2】 , 【note3】 |
| 20      | LVDS_SET | LVDS_SET                                       | 【note1】 , 【note3】 |

【note2】

HANTEN = " LOW "



HANTEN = " High "



【note3】

Pull-up resistor lower than 12kΩ can be used.

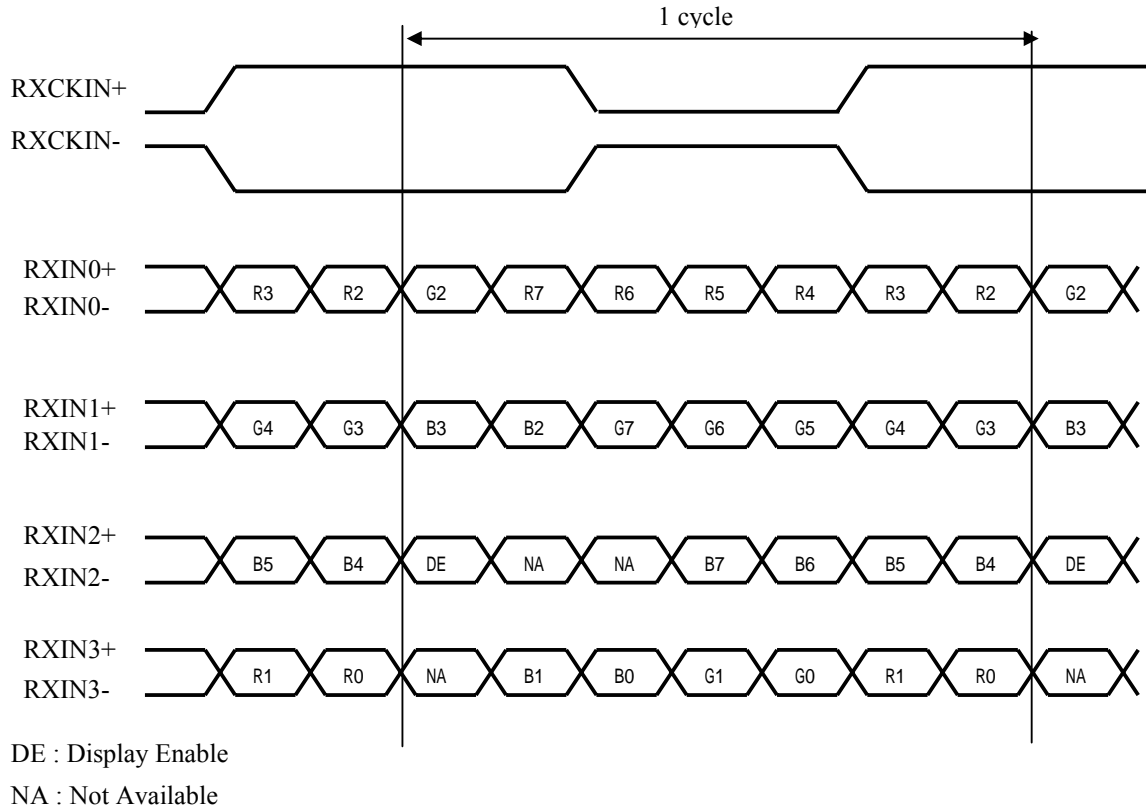
## 4-2. Data Mapping

## 1) 8 bit input

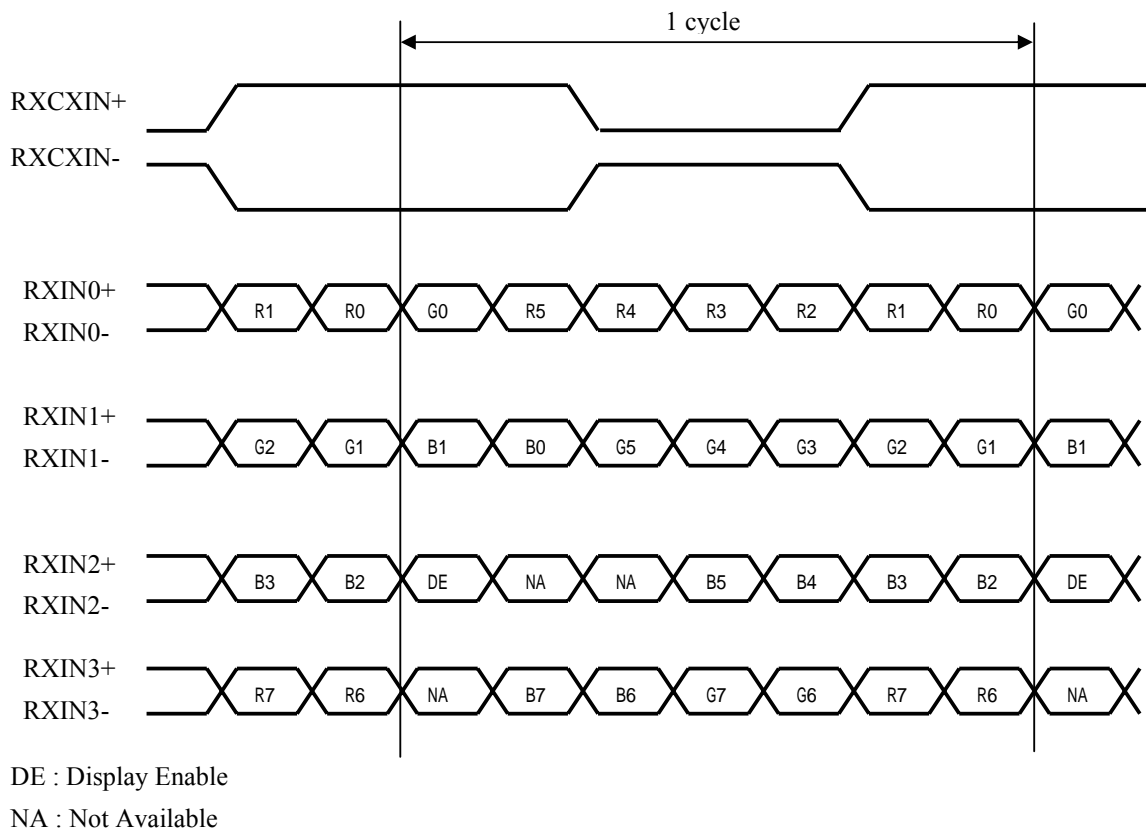
【note1】 pin assignment with LVDS\_SET pin (Thine: THC63LVDF83A)

| Transmitter |        | 20pin LVDS_SET |             |
|-------------|--------|----------------|-------------|
| Pin No      | Data   | = L (GND)      | = H (3.3V)  |
| 51          | TA0    | R2             | R0 (LSB)    |
| 52          | TA1    | R3             | R1          |
| 54          | TA2    | R4             | R2          |
| 55          | TA3    | R5             | R3          |
| 56          | TA4    | R6             | R4          |
| 3           | TA5    | R7 (MSB)       | R5          |
| 4           | TA6    | G2             | G0 (LSB)    |
| 6           | TB0    | G3             | G1          |
| 7           | TB1    | G4             | G2          |
| 11          | TB2    | G5             | G3          |
| 12          | TB3    | G6             | G4          |
| 14          | TB4    | G7 (MSB)       | G5          |
| 15          | TB5    | B2             | B0 (LSB)    |
| 19          | TB6    | B3             | B1          |
| 20          | TC0    | B4             | B2          |
| 22          | TC1    | B5             | B3          |
| 23          | TC2    | B6             | B4          |
| 24          | TC3    | B7 (MSB)       | B5          |
| 27          | TC4    | High or low    | High or low |
| 28          | TC5    | High or low    | High or low |
| 30          | TC6    | DE             | DE          |
| 50          | TD0    | R0 (LSB)       | R6          |
| 2           | TD1    | R1             | R7 (MSB)    |
| 8           | TD2    | G0 (LSB)       | G6          |
| 10          | TD3    | G1             | G7 (MSB)    |
| 16          | TD4    | B0 (LSB)       | B6          |
| 18          | TD5    | B1             | B7 (MSB)    |
| 25          | TD6    | (NA)           | (NA)        |
| 31          | CLK IN | CLK            | CLK         |

<LVDS\_SET = L >



<LVDS\_SET = H >

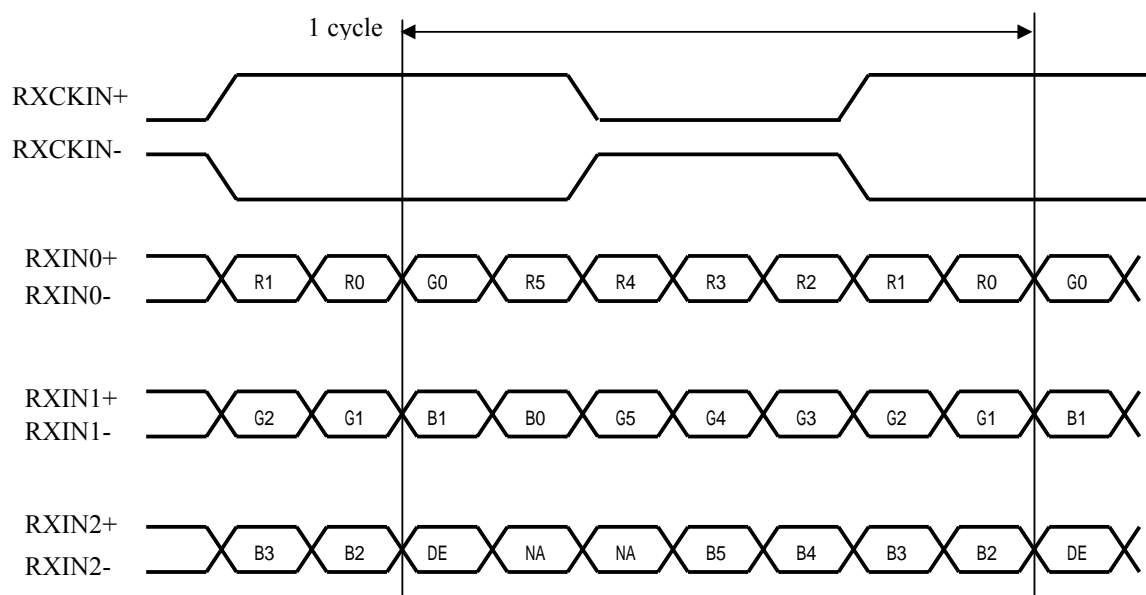




## 2) 6 bit input

【note1】 pin assignment with LVDS\_SET pin (Thine: THC63LVDF83A)

| Transmitter |       | 20pin LVDS_SET |            |
|-------------|-------|----------------|------------|
| Pin No      | Data  | = L (GND)      | = H (3.3V) |
| 51          | TA0   | R0 (LSB)       | -          |
| 52          | TA1   | R1             | -          |
| 54          | TA2   | R2             | -          |
| 55          | TA3   | R3             | -          |
| 56          | TA4   | R4             | -          |
| 3           | TA5   | R5 (MSB)       | -          |
| 4           | TA6   | G0 (LSB)       | -          |
| 6           | TB0   | G1             | -          |
| 7           | TB1   | G2             | -          |
| 11          | TB2   | G3             | -          |
| 12          | TB3   | G4             | -          |
| 14          | TB4   | G5 (MSB)       | -          |
| 15          | TB5   | B0 (LSB)       | -          |
| 19          | TB6   | B1             | -          |
| 20          | TC0   | B2             | -          |
| 22          | TC1   | B3             | -          |
| 23          | TC2   | B4             | -          |
| 24          | TC3   | B5 (MSB)       | -          |
| 27          | TC4   | High or low    | -          |
| 28          | TC5   | High or low    | -          |
| 30          | TC6   | DE             | -          |
| 50          | TD0   | GND            | -          |
| 2           | TD1   | GND            | -          |
| 8           | TD2   | GND            | -          |
| 10          | TD3   | GND            | -          |
| 16          | TD4   | GND            | -          |
| 18          | TD5   | GND            | -          |
| 25          | TD6   | (NA)           | -          |
| 31          | CIKIN | CLK            | -          |



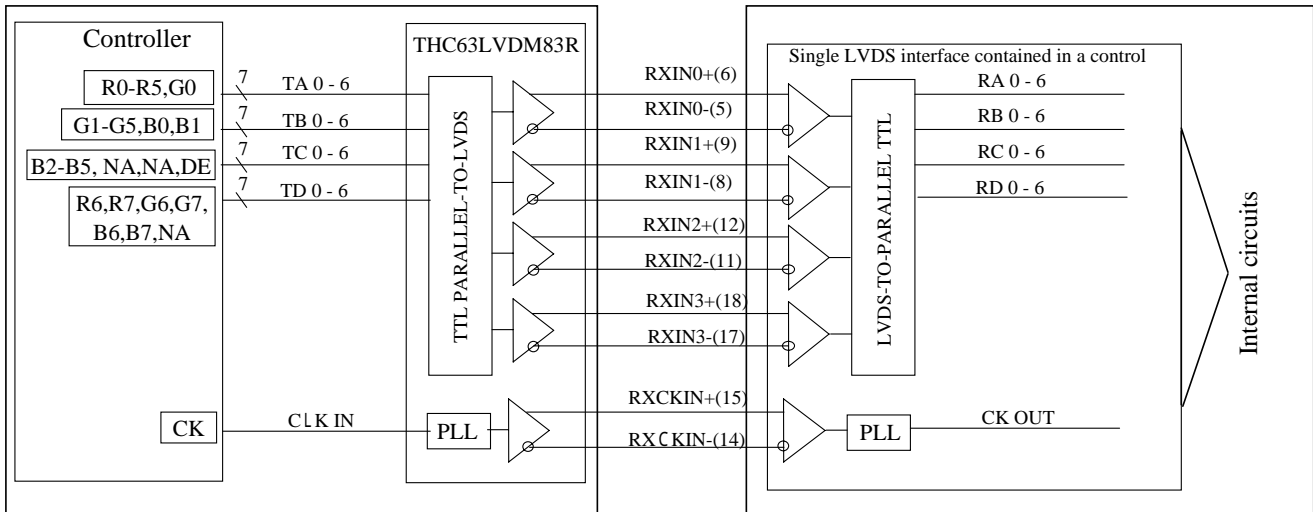
DE : Display Enable

NA : Not Available

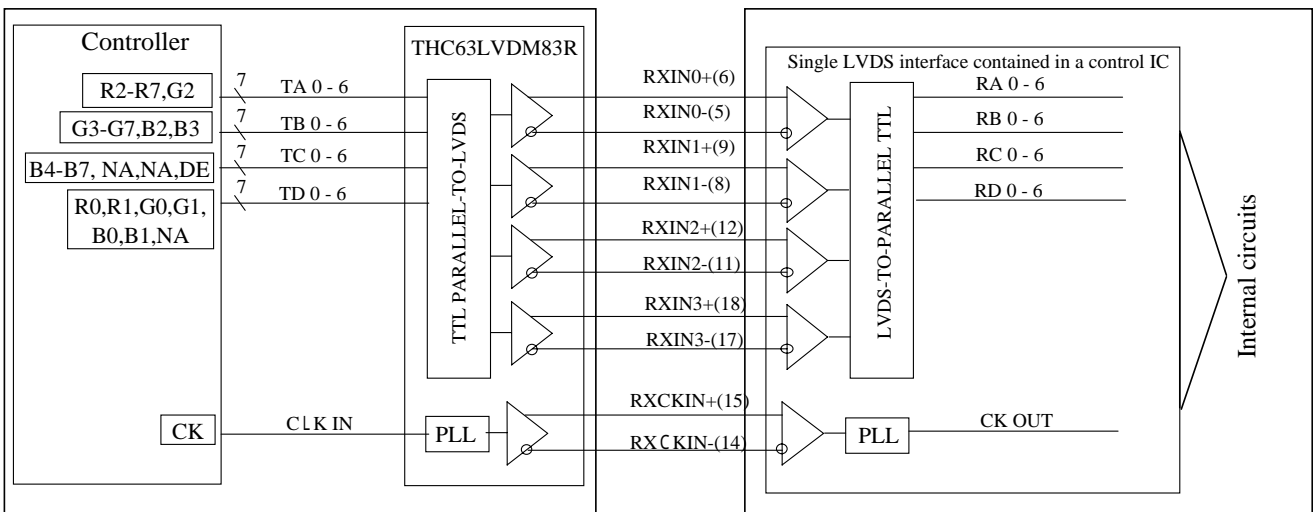
(Computer Side)

(TFT-LCD side)

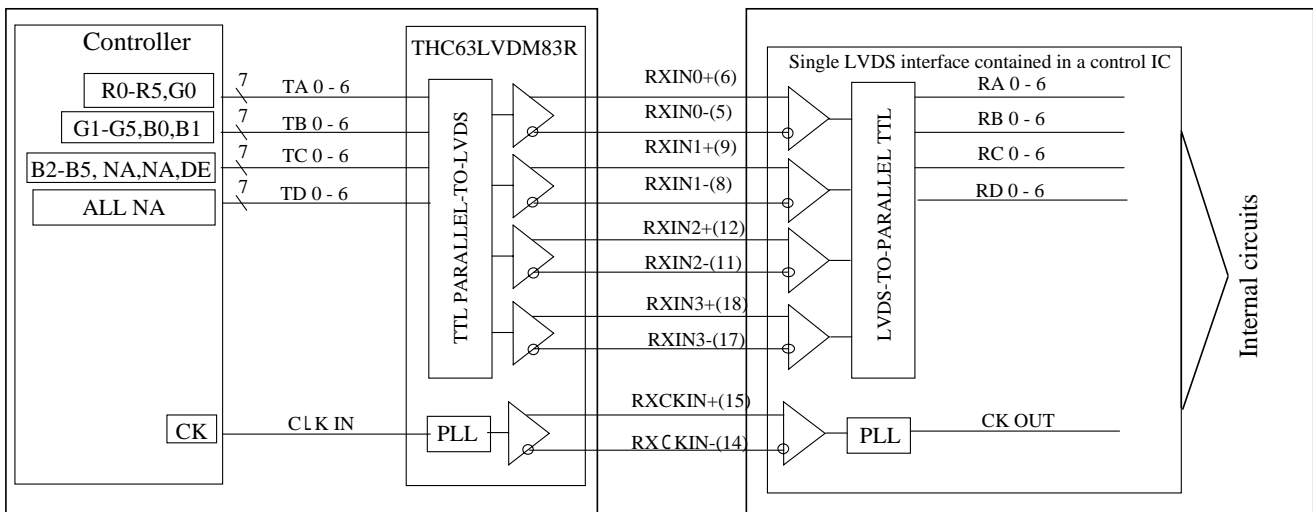
8Bit Mode  
LVDS\_SET=H (20 pin=3.3[V])



8Bit Mode  
LVDS\_SET=L (20 pin=GND)



6Bit Mode  
LVDS\_SET=L (20 pin=GND)



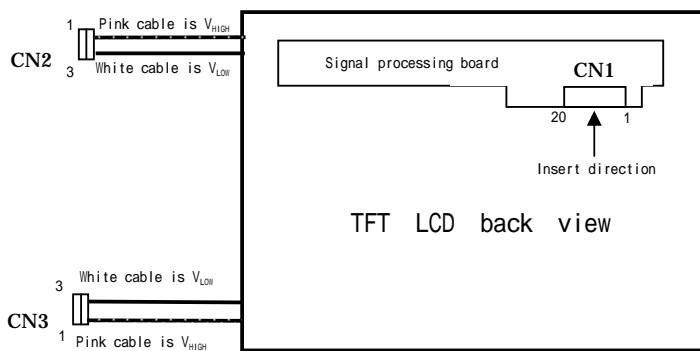
## 4-4. Backlight

CN 2, 3

The module-side connector : BHR-03VS-1 (JST)

The user-side connector : SM02(8.0)B-BHS-1-TB(LF)(SN) (JST)

| Pin no. | symbol     | I/O | Function                                  | Color |
|---------|------------|-----|---|-------|
| 1       | $V_{HIGH}$ | I   | Power supply for lamp (High voltage side) | Pink  |
| 2       | N.C.       | -   | -   |       |
| 3       | $V_{LOW}$  | I   | Power supply for lamp (Low voltage side)  | White |



## 5. Absolute Maximum Ratings

| Parameter             | Symbol    | Condition | Ratings                              | Unit | Remark  |
|-----------------------|-----------|-----------|--------------------------------------|------|---------|
| Supply voltage        | $V_{CC}$  | $T_a=25$  | -0.3 ~ +4.0                          | V    |         |
| Input voltage         | $V_I$     | $T_a=25$  | -0.3 ~ $V_{CC}+0.3$                  | V    |         |
| Storage temperature   | $T_{STG}$ | -         | -25 ~ +60                            |      | 【Note1】 |
| Operating temperature | $T_{opa}$ |           | 0 (Ambient) ~<br>+60 (Panel surface) |      |         |
| Lamp Voltage          | $V_{La}$  | -         | 2000                                 | Vrms |         |

【Note1】 Humidity : 95%RH Max. ( $T_a$  40 )Maximum wet-bulb temperature at 39 or less. ( $T_a>40$  )

No condensation.

## 6. Recommended operation condition

| Parameter           | Symbol    | Min. | Typ. | Max.     | Unit | Remark  |
|---------------------|-----------|------|------|----------|------|---------|
| Supply voltage      | $V_{CC}$  | +3.0 | +3.3 | +3.6     | V    | 【Note1】 |
| LVDS Signals        | $V_L$     | 0    |      | 2.4      | V    | 【Note2】 |
| Input voltage       | $V_I$     | 0    |      | $V_{CC}$ | V    | 【Note3】 |
| Surface temperature | $T_{opa}$ | 0    |      | +60      |      | 【Note4】 |

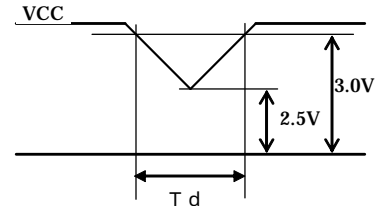
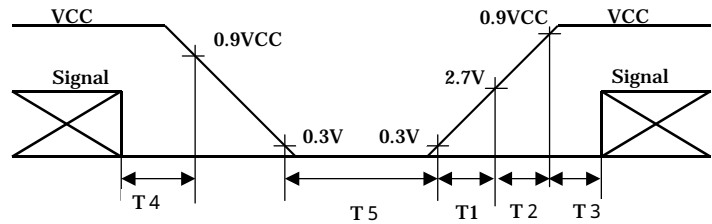
**【Note1】 On-off conditions for supply voltage**

- 0<t1 15ms
- 0<t2 10ms
- 0<t3 100ms
- 0<t4 1s
- 200ms<t5

**Vcc-dip conditions**

- 1)  $V_2 \quad V_{cc} < 3.0V$   
td 10ms
- 2)  $V_{cc} < 2.5V$

Vcc-dip conditions should also follow the On-off conditions for supply voltage



**【Note2】 RXIN0-, RXIN0+, RXIN1-, RXIN1+, RXIN2-, RXIN2+, RXCKIN-, RXCKIN+, RXIN3-, RXIN3+**

**【Note3】 LVDS\_SET、 HANTEN**

**【Note4】 Humidity: 95%RH Max. at Ta=<40°C.**

Maximum wet-bulb temperature at 39°C or less at Ta>40

No condensation.

Maximum value : Panel surface temperature

**7. Electrical Characteristics**

**7-1. TFT-LCD panel driving**

Ta = 25

| Parameter                             |                     | Symbol          | Min. | Typ. | Max. | Unit  | Remark                                   |
|---------------------------------------|---------------------|-----------------|------|------|------|-------|--|
| Vcc                                   | Supply voltage      | Vcc             | +3.0 | +3.3 | +3.6 | V     | -  |
|                                       | Current dissipation | Icc             | -    | 350  | 450  | mA    | <b>【Note2】</b>                           |
| Permissive input ripple voltage       |                     | V <sub>RF</sub> | -    | -    | 100  | mVp-p | V <sub>cc</sub> =+3.3V                   |
| Differential input Threshold voltage  | High                | V <sub>TH</sub> | -    | -    | +100 | mV    | V <sub>CM</sub> =+1.2V<br><b>【Note1】</b> |
|                                       | Low                 | V <sub>TL</sub> | -100 | -    | -    | mV    |  |
| Input voltage width for LVDS receiver |                     | V <sub>i</sub>  | 0    | -    | 2.4  | V     | -  |
| Input voltage                         | High                | V <sub>IH</sub> | 2.1  | -    | -    | V     | <b>【Note3】</b>                           |
|                                       | Low                 | V <sub>IL</sub> | -    | -    | 0.6  | V     |  |
| Terminal resistor                     |                     | R <sub>T</sub>  | -    | 100  | -    |       | Differential input                       |

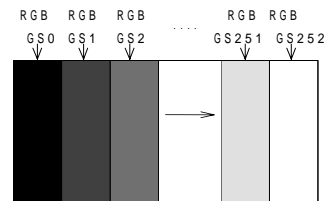
**【Note1】** V<sub>CM</sub> : Common mode voltage of LVDS driver.

**【Note2】** Typical current situation : 253-gray-bar pattern

V<sub>cc</sub>=+3.3V, f<sub>ck</sub>=65MHz, Ta=25

Gray scale : GS(n)

**【Note3】** HANTEN, LVDS\_SET



## 7-2. Backlight

The back light system is an edge-lighting type with 2 CCFTs (Cold Cathode Fluorescent Tube).

The characteristics of the lamp are shown in the following table.

The value mentioned below is at the case of one CCFT.

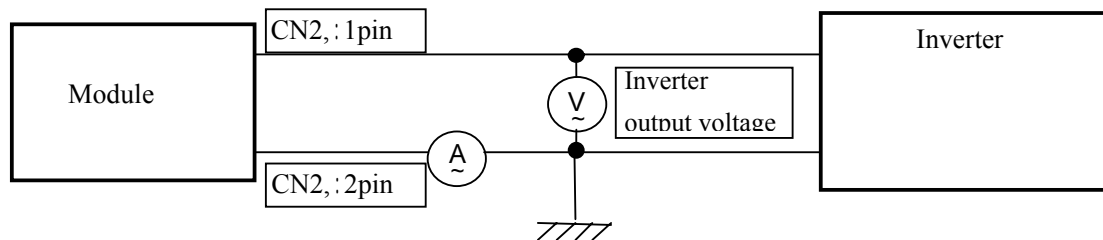
| Parameter              | Symbol | Min.   | Typ. | Max.  | Unit  | Remark                            |
|------------------------|--------|--------|------|-------|-------|-----------------------------------|
| Lamp current range     | $I_L$  | 3.5    | 6.5  | 7.5   | mArms | 【Note1】                           |
| Lamp voltage           | $V_L$  | -      | 660  | -     | Vrms  | $I_L=6.5$ mArms $T_a=25$ 55kHz    |
| Lamp power consumption | $P_L$  | -      | 4.3  | -     | W     | 【Note2】                           |
| Lamp frequency         | $F_L$  | 40     | 55   | 70    | kHz   | 【Note3】                           |
| Kick-off voltage       | $V_s$  | -      | -    | 1,400 | Vrms  | Transformer output【Note4】 $T_a=0$ |
| Lamp life time         | $T_L$  | 50,000 | -    | -     | hour  | 【Note5】                           |

【Note1】 A lamp can be light in the range of lamp current shown above.

Maximum rating for current is measured by high frequency current measurement equipment connected to  $V_{LOW}$  at circuit showed below.

(Note : To keep enough kick-off voltage and necessary steady voltage for CCFT.)

Panel surface temperature : 0 ~ 60



【Note2】 Referential data per one CCFT by calculation ( $I_L \times V_L$ ).

The data don't include loss at inverter. ( $I_L=6.5$  mArms)

【Note3】 Lamp frequency of inverter may produce interference with horizontal synchronous frequency, and this may cause horizontal beat on the display. Therefore, adjust lamp frequency, and keep inverter as far as from module or use electronic shielding between inverter and module to avoid interference.

【Note4】 The open output voltage of the inverter shall be maintained for more than 1s; otherwise the lamp may not be turned on.

【Note5】 Above value is applicable when lamp is placed horizontally.

Lamp life time is defined that it applied either or under this condition (Continuous turning on at  $T_a=25^\circ\text{C}$ ,  $I_L=6.5$  mArms)

Brightness becomes 50% of the original value under standard condition.

Kick-off voltage at  $T_a=0^\circ\text{C}$  exceeds maximum value, (1,400)Vrms.

(Lamp life time may vary if lamp is in portrait position due to the change of mercury density inside the lamp.)

Lamp life time shortens according to the state of mounting and use.

In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower.(Continuous operating for around 1 month under lower temp condition may reduce the brightness to half of the original brightness.)

In case of such usage under lower temp environment, periodical lamp exchange is recommended.

【Note6】 The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occur. when you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Be sure to use a back light power supply with the safety protection circuit such as the detection circuit for the excess voltage, excess current and or electric discharge waveform.

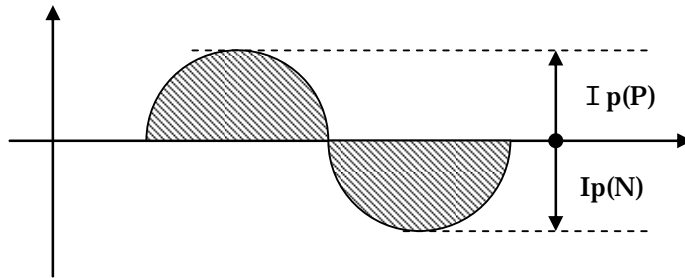
Be sure to use the detect circuit by which one side of the CCFT lamps can be controlled independently. Otherwise, when one side of the CCFT is open, the excess current may possibly be applied to the other side of the lamp.

【Note7】 It is required to have the inverter designed so that to allow the impedance deviation of the two CCFT lamps and the capacity deviation of barast capacitor.

【Note8】 Under the environment of 10 lx or less, lamp may not turn on or it may take some time to turn on.

【Note9】 A lamp waveform should satisfy the following conditions.

Wave efficiency : 1.20  $I_p(P) / I_{rms}$  or  $I_p(N) / I_{rms}$  1.63  
 Imbalanced value: 0.95  $I_p(P) / I_p(N)$  1.05

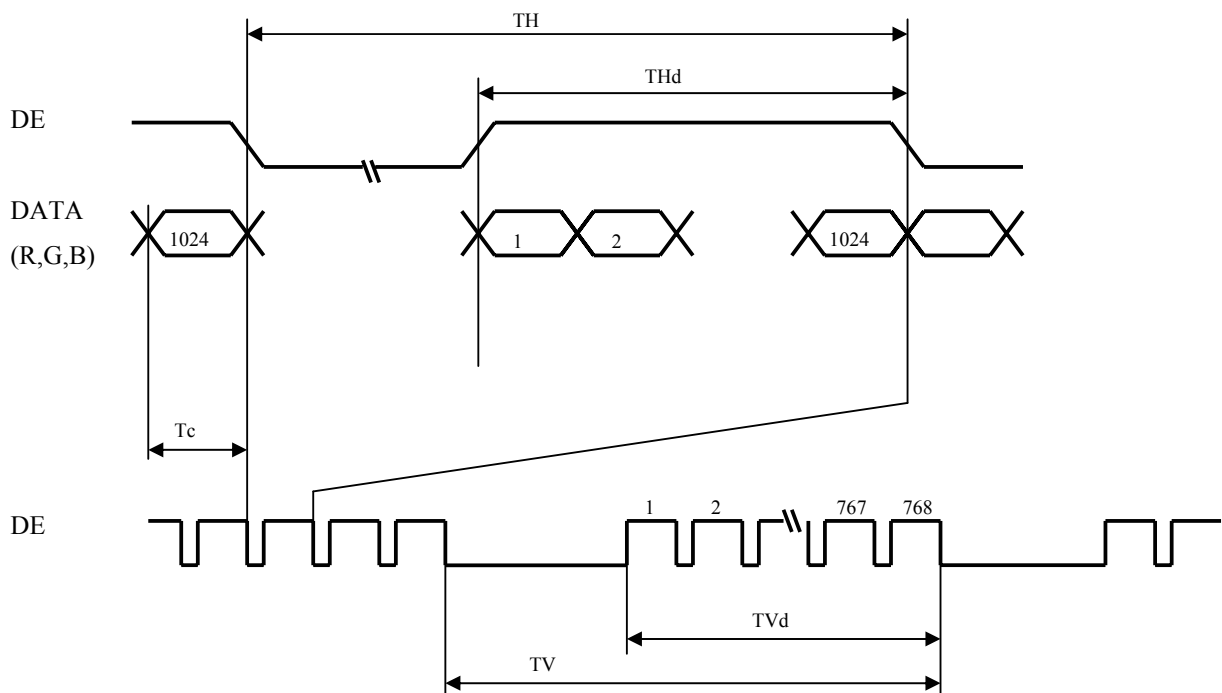


8. Timing characteristics of input signals

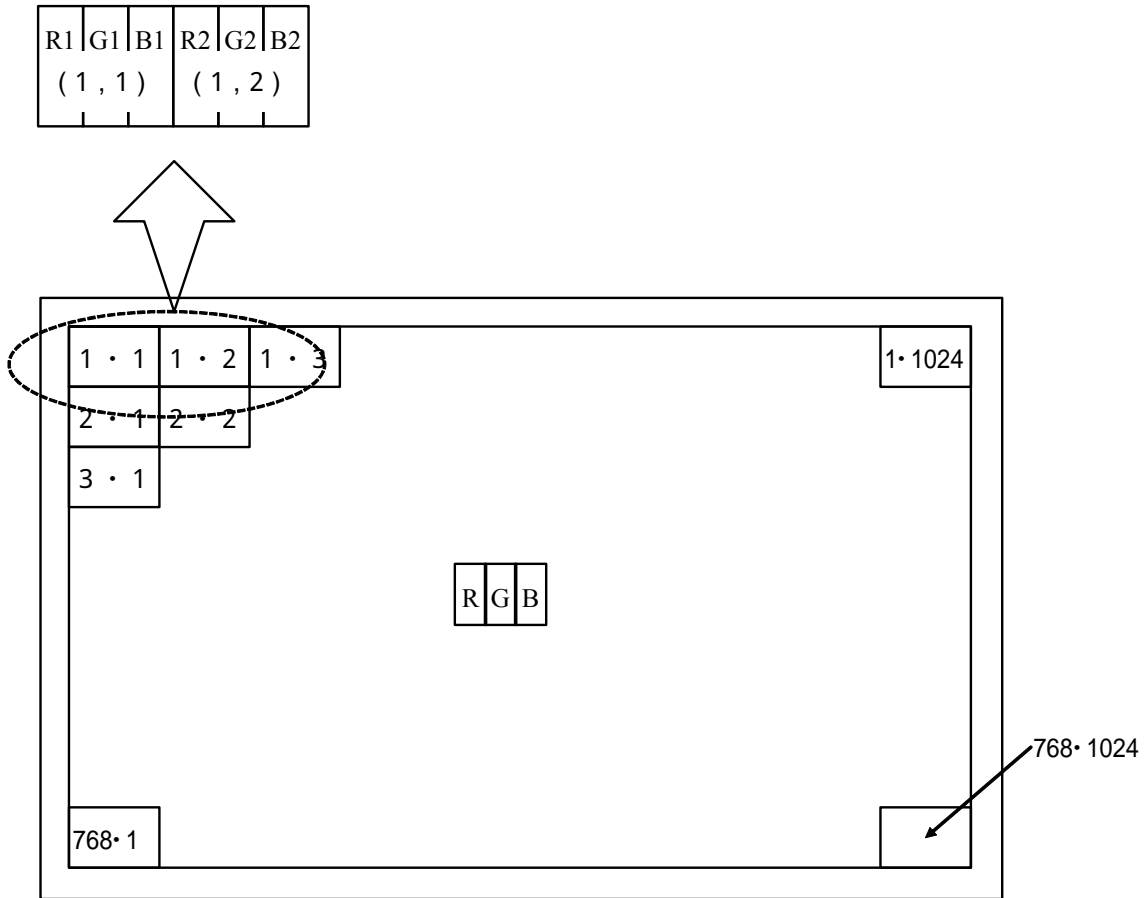
8-1. Timing characteristics

| Parameter              |                          | Symbol | Min.  | Typ.  | Max.  | Unit  |
|------------------------|--------------------------|--------|-------|-------|-------|-------|
| Clock signal           | Frequency                | 1/Tc   | 50.0  | 65.0  | 80.0  | MHz   |
| ENAB signal            | Horizontal period        | TH     | 1056  | 1344  | 1720  | clock |
|                        |                          |        | 16.0  | 20.7  | 23.4  | μs    |
|                        | Horizontal period (High) | THd    | 1024  | 1024  | 1024  | clock |
|                        | Vertical Frequency       | fv     | 54    | 60    | 77    | Hz    |
|                        | Vertical period          | TV     | 773   | 806   | 990   | line  |
|                        |                          |        | 12.98 | 16.66 | 18.51 | ms    |
| Vertical period (High) | TVd                      | 768    | 768   | 768   | line  |       |

【Note】 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.



## 8-2. Input Data Signals and Display Position on the screen



Display Position of Data (V,H)

9. Input Signals, Basic Display Colors and Gray Scale of Each Color

9-1. 8bit input

|                     | Colors & Gray scale | Data signal |     |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---------------------|---------------------|-------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                     |                     | Gray Scale  | R0  | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
| Basic Color         | Black               | -           | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue                | -           | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Green               | -           | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Cyan                | -           | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Red                 | -           | X   | X  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Magenta             | -           | X   | X  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow              | -           | X   | X  | 1  | 1  | 1  | 1  | 1  | 1  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White               | -           | X   | X  | 1  | 1  | 1  | 1  | 1  | 1  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Gray Scale of Red   | Black       | GS0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| ↑                   |                     | GS1         | 1   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Darker              |                     | GS2         | 0   | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| ↑                   |                     | ↓           |     |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |
| ↓                   |                     | ↓           |     |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |
| Brighter            |                     | GS250       | 0   | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| ↓                   |                     | GS251       | 1   | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Red                 |                     | GS252       | X   | X  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Green |                     | Black       | GS0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | GS1         | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker              | GS2         | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | ↓           |     |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |
|                     | ↓                   | ↓           |     |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |
|                     | Brighter            | GS250       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↓                   | GS251       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green               | GS252       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Gray Scale of Blue  | Black       | GS0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| ↑                   |                     | GS1         | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Darker              |                     | GS2         | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| ↑                   |                     | ↓           |     |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |
| ↓                   |                     | ↓           |     |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |
| Brighter            |                     | GS250       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  |
| ↓                   |                     | GS251       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  |
| Blue                |                     | GS252       | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | X  | 1  | 1  | 1  | 1  | 1  | 1  |

0 : Low level voltage,      1 : High level voltage.      X :Don't care

Each basic color can be displayed in 253 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen.



## 9-2. 6bit input

|                     | Colors & Gray scale | Data signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---------------------|---------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                     |                     | Gray Scale  | R0 | R1 | R2 | R3 | R4 | R5 | G0 | G1 | G2 | G3 | G4 | G5 | B0 | B1 | B2 | B3 | B4 | B5 |
| Basic Color         | Black               | -           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue                | -           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Green               | -           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Cyan                | -           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Red                 | -           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Magenta             | -           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow              | -           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White               | -           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale of Red   | Black               | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | GS1         | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker              | GS2         | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | ↓           | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |    |    |
|                     | ↓                   | ↓           | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |    |    |
|                     | Brighter            | GS61        | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↓                   | GS62        | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red                 | GS63        | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Green | Black               | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | GS1         | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker              | GS2         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | ↓           | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |    |    |
|                     | ↓                   | ↓           | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |    |    |
|                     | Brighter            | GS61        | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↓                   | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green               | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Blue  | Black               | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑                   | GS1         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker              | GS2         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  |
|                     | ↑                   | ↓           | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |    |    |
|                     | ↓                   | ↓           | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |    |    |
|                     | Brighter            | GS61        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  |
|                     | ↓                   | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  |
|                     | Blue                | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |

0 : Low level voltage,      1 : High level voltage.

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

## 10. Optical Characteristics

Ta=25 , Vcc =+3.3V

| Parameter               |            | Symbol | Condition | Min.  | Typ.  | Max.  | Unit              | Remark    |   |
|-------------------------|------------|--------|-----------|-------|-------|-------|-------------------|-----------|---|
| Viewing angle range     | Vertical   | 11     | CR 10     | 30    | 45    | -     | Deg.              | 【Note1,4】 |   |
|                         |            | 12     |           | 45    | 55    | -     | Deg.              |           |   |
|                         | Horizontal | 21, 22 |           | 50    | 60    | -     | Deg.              |           |   |
| Contrast ratio          |            | C R    | =0 °      | 400   | 550   | -     |                   | 【Note2,4】 |   |
| Response Time           | Rise       | r      | =0 °      | -     | 2     | -     | ms                | 【Note3,4】 |   |
|                         | Fall       | d      |           | -     | 6     | -     | ms                |           |   |
| Chromaticity of White   |            | x      |           | 0.283 | 0.313 | 0.343 |                   | 【Note4】   |   |
|                         |            | y      |           | 0.299 | 0.329 | 0.359 |                   |           |   |
| Chromaticity of Red 2   |            | x      |           | 0.567 | 0.597 | 0.627 |                   |           |   |
|                         |            | y      |           | 0.297 | 0.327 | 0.357 |                   |           |   |
| Chromaticity of Green 2 |            | x      |           | 0.292 | 0.322 | 0.352 |                   |           |   |
|                         |            | y      |           | 0.545 | 0.575 | 0.605 |                   |           |   |
| Chromaticity of Blue 2  |            | x      |           | 0.123 | 0.153 | 0.183 |                   |           |   |
|                         |            | y      |           | 0.103 | 0.133 | 0.163 |                   |           |   |
| Luminance of white      |            | YL     |           | 200   | 250   | -     | cd/m <sup>2</sup> |           | I <sub>L</sub> =6.5mA rms<br>f <sub>L</sub> =55kHz<br>【Note4】 |
| White Uniformity        |            | w      |           | -     | -     | 1.25  |                   |           | 【Note5】   |

The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.2 below.

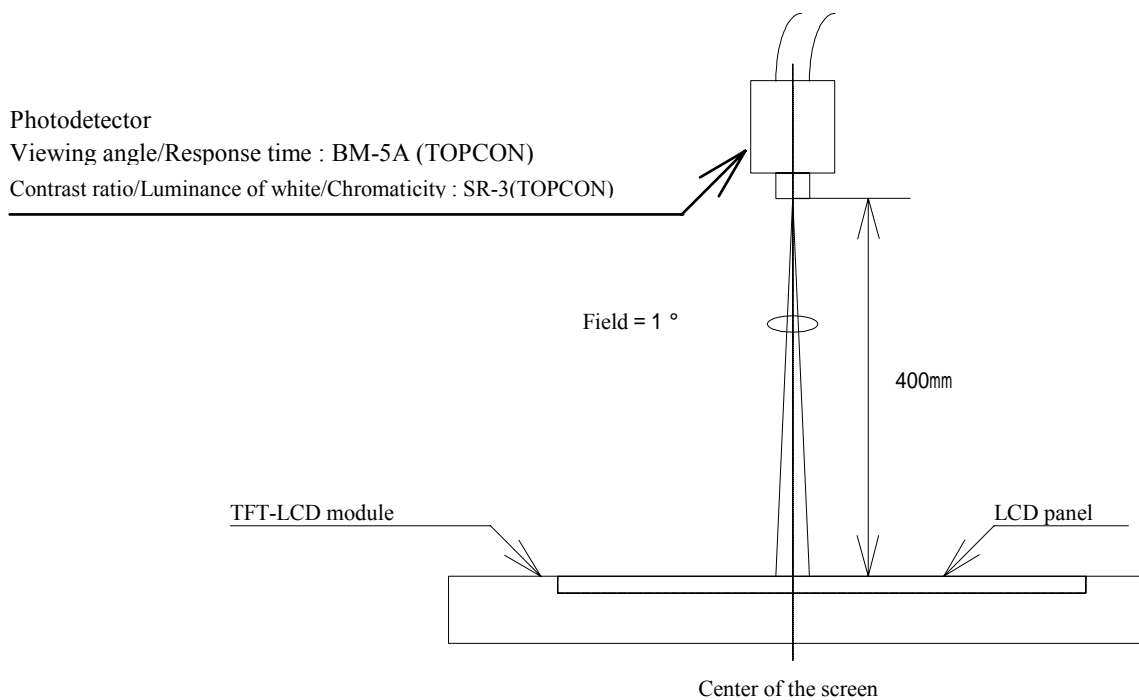
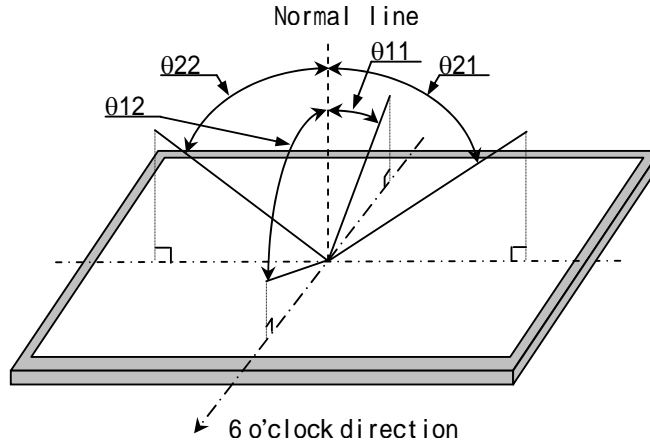


Fig.2 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



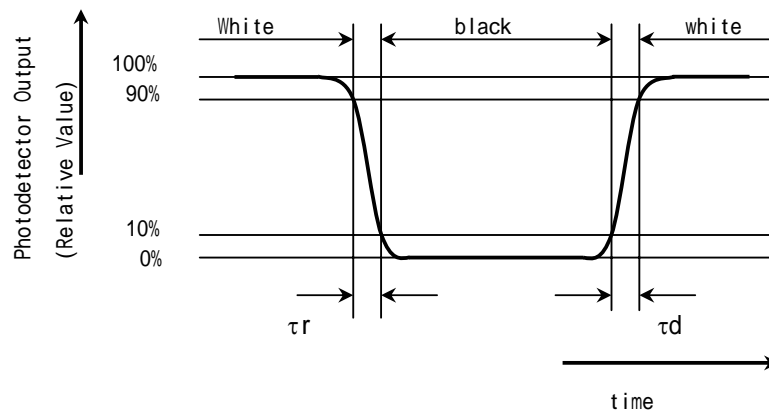
【Note2】 Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

【Note3】 Definition of response time:

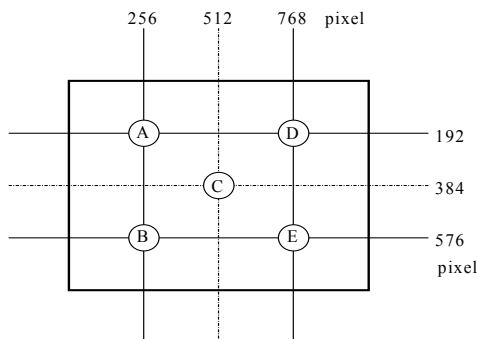
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



【Note4】 This shall be measured at center of the screen.

【Note5】 Definition of white uniformity:

White uniformity is defined as the following with five measurements (A ~ E).



$$w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

## 11. Handling Precautions

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
- b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- c) Since the front polarizer is easily damaged, pay attention not to scratch it.  
Blow away dust on the polarizer with antistatic N<sub>2</sub> blow. It is undesirable to wipe off because a polarizer is sensitive. It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer. When unavoidable, wipe off carefully with a cloth for wiping lenses.
- d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.  
Handle with care.
- g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.
- h) Since there is a circuit board in the module back, stress is not added at the time of a design assembly.  
Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.
- i) Protection film is attached to the module surface to prevent it from being scratched .  
Peel the film off slowly , just before the use, with strict attention to electrostatic charges.  
Blow off 'dust' on the polarizer by using an ionized nitrogen.
- j) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
- k) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.
- l) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.
- m) There are high voltage portions on the backlight and very dangerous. Careless touch may lead to electrical shock.  
When exchange lamps or service, turn off the power without fail.
- n) When handling LCD modules and assembling them into cabinets, please avoid that long-terms storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the modules.
- o) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.
- p) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.
- q) When install LCD modules in the cabinet, please tighten with “torque = (0.34)N· m(Max).  
Be sure to confirm it in the same condition as it is installed in your instrument.
- r) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
- s) Notice : Never dismantle the module , because it will cause failure.
- t) Be careful when using it for long time with fixed pattern display as it may cause afterimage.  
(Please use a screen saver etc., in order to avoid an afterimage.)
- u) Adjusting volume have been set optimally before shipment, so do not change any adjusted value.  
If adjusted value is changed, the specification may not be satisfied.
- v) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
- w) The lamp used for this product is very sensitive to the temperature.  
Luminance decreases rapidly when it is used for a long time or repeatedly under the environment of the low temperature or the module is being cooled.  
Please avoid the continuous or repeating use of it under such an environment.  
It may decrease up to 50% of the initial luminance in about one month under the low temperature environment.  
Please consult our company when it is used under the environment like the above mentioned.

- x) In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower.(Continuous operating for around 1 month under lower temp condition may reduce the brightness to half of the original brightness.)  
The life of a lamp is accelerated when using it in the environment where a lamp cannot get warm easily.  
( When using it outdoors and ON/OFF is repeated frequently )  
In case of such usage under lower temp environment, periodical lamp check and exchange is recommended.

## 12. Packing form

|   |                       |
|---|-----------------------|
| Product countries / Areas                         | JAPAN , TAIWAN, CHINA |
| Piling number of cartons                          | 6                     |
| Package quantity in one carton                    | 10pcs                 |
| Carton size(TYP)                                  | 434mm x 395mm x 338mm |
| Total mass of one carton filled with full modules | 13kg (TYP.)           |
| Packing form is shown                             | Fig.4                 |

## 13 . Reliability test items

| No | Test item                                       | Conditions  |                 |
|----|---|---|-----------------|
| 1  | High temperature & high humidity operation test | Ta = 40 ; 95%RH 240h<br>(No condensation)   |                 |
| 2  | High temperature operation test                 | Tp = 60 240h  | Panel Surface   |
| 3  | High temperature storage test                   | Ta = 60 240h  |                 |
| 4  | Low temperature operation test                  | Ta = 0 240h   |                 |
| 5  | Low temperature storage test                    | Ta = -25 240h   |                 |
| 6  | Vibration test<br>(non- operating)              | Waveform : Sine wave<br>Frequency : 10 ~ 57Hz/Vibration width (one side) : 0.075mm<br>: 57 ~ 500Hz/Gravity : 9.8m/s <sup>2</sup><br>Sweep time : 11minutes<br>Test period : 3 hours<br>(1 hour for each direction of X,Y,Z) | <b>【 Note 】</b> |
| 7  | Shock test<br>(non- operating)                  | Max. gravity : 490m/s <sup>2</sup><br>Pulse width : 11ms, half-sine wave<br>Direction : ± X, ± Y, ± Z,<br>once for each direction.  |                 |
| 8  | Thermal shock test<br>(Storage)                 | Ta=-25 ~ 60 ; 5 cycles<br>Test period : 10 hours (1 hour for each temperature)  | <b>【 Note 】</b> |
| 9  | Altitude  | Ta=50 ,70kPa,3,048m(10,000ft), t=24h (Operating)<br>Ta=70 ,12kPa,15,240m(50,000ft), t=24h (Storage)   |                 |

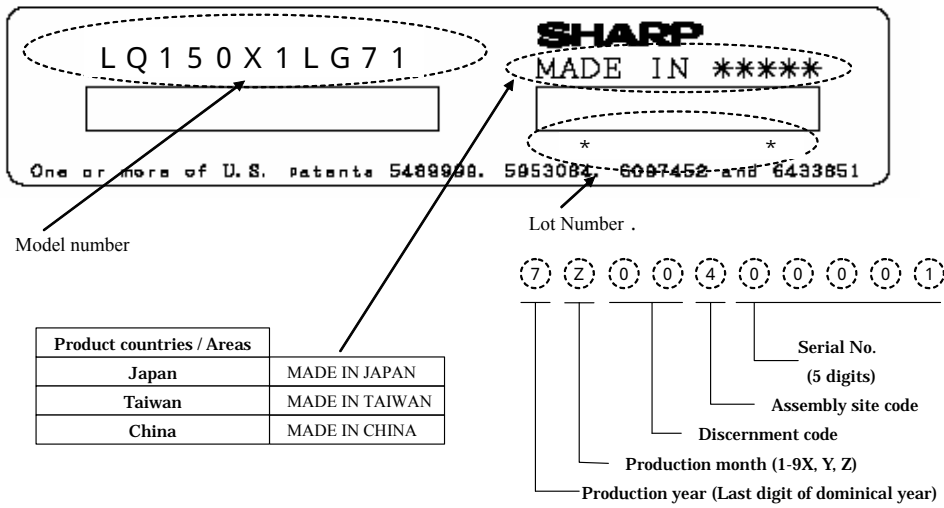
**【 Note 】** A gap of panel shall not occur by vibration or the shock.

**【 Result Evaluation Criteria 】**

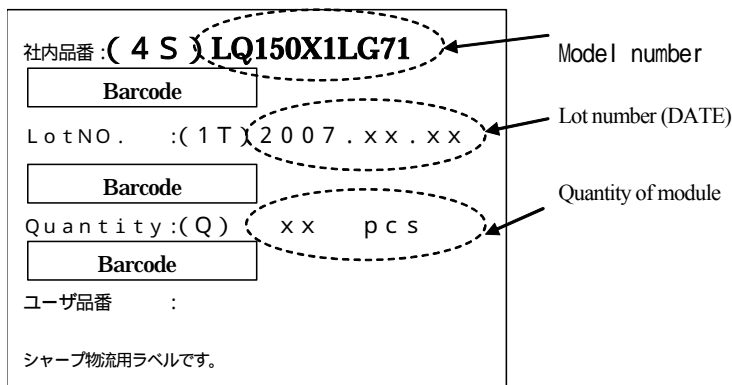
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state : Temperature:15 ~ 35 , Humidity:45 ~ 75%, Atmospheric pressure:86 ~ 106kpa)

14. Others

14-1. Lot No. Label:



14-2. Packing box Label:



Internal Use Only  
R . C .

R.C. ( RoHs Compliance ) means these parts have corresponded with the RoHs directive.

14-3. If any problem occurs in relation to the description of this specification , it shall be resolved through discussion with spirit of cooperation.

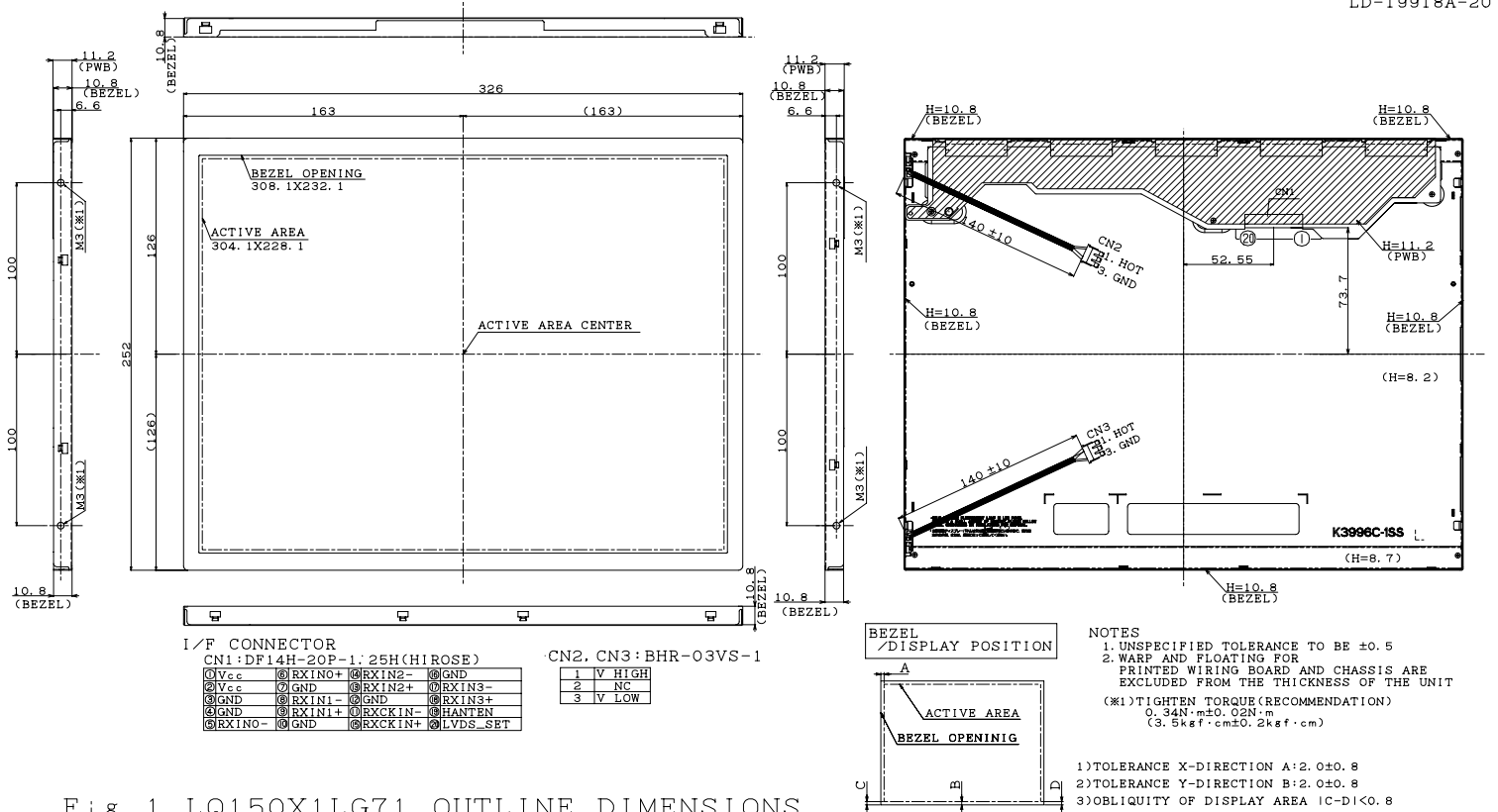


Fig. 1 LQ150X1LG71 OUTLINE DIMENSIONS

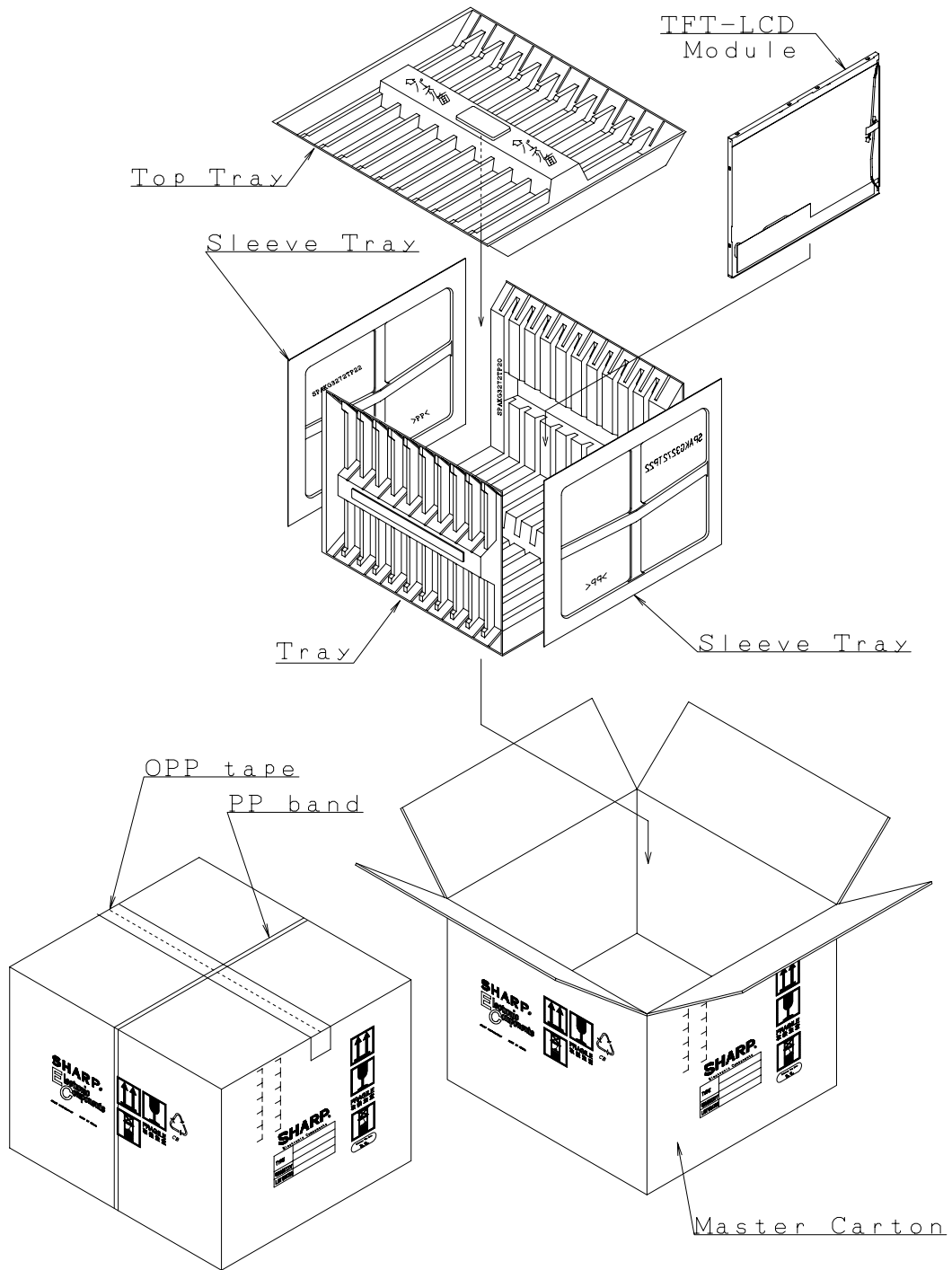


Fig4. Packing Form



# LCD Specification

## LCD Group



### 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  
www.sharpsma.com

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