

PRODUCT SPECIFICATIONS

SHARP

AVC Liquid Crystal Displays Group

LQ150X1LGB1

TFT-LCD Module

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AVC Liquid Crystal Display GROUP
SHARP CORPORATION

APPLICABLE GROUP
AVC Liquid Crystal Display
Group

SPECIFICATION

DEVICE SPECIFICATION

TFT-LCD Module

MODEL

LQ150X1LGB1

These parts have corresponded with the RoHS directive.

CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY *K. Shiono*

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Department General Manager

DEVELOPMENT ENGINEERING DEPT. II

TAKI DEVELOPMENT CENTER

AVC LIQUID CRYSTAL DISPLAY GROUP

SHARP CORPORATION

1. Application

This specification applies to the color 15.0 XGA TFT-LCD module LQ150X1LGB1.

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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.

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 | 331.6(W)×254.76(H)×12.5(D) | mm |
| Mass | 1200±50 | g |
| Surface treatment | Anti-glare and hard-coating : 2H | |

*1.Note: excluding back light cables.

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(Connector) (Hirose Electric Co., Ltd.)

DF14-2628SCFA(Terminal) (Hirose Electric Co., Ltd.)

Using LVDS Receiver : Contained in a control IC. [THC63LVDF84A(Thine) compatible]

Corresponding LVDS Transmitter : THC63LVDM83R(Thine) or DSC90C385AMT(NS) or compatible

| Pin No. | Symbol | Function | Remark |
|---------|----------|--------------------------|----------------|
| 1 | Vcc | +3.3V Power supply | |
| 2 | Vcc | +3.3V Power supply | |
| 3 | GND | Ground | |
| 4 | GND | Ground | |
| 5 | RxIN0- | LVDS CH0 data signal (-) | LVDS |
| 6 | RxIN0+ | LVDS CH0 data signal (+) | LVDS |
| 7 | GND | Ground | |
| 8 | RxIN1- | LVDS CH1 data signal (-) | LVDS |
| 9 | RxIN1+ | LVDS CH1 data signal (+) | LVDS |
| 10 | GND | Ground | |
| 11 | RxIN2- | LVDS CH2 data signal (-) | LVDS |
| 12 | RxIN2+ | LVDS CH2 data signal (+) | LVDS |
| 13 | GND | Ground | |
| 14 | RxCLKIN- | LVDS CK- data signal (-) | LVDS |
| 15 | RxCLKIN+ | LVDS CK+ data signal (+) | LVDS |
| 16 | GND | Ground | |
| 17 | RxIN3- | LVDS CH3 data signal (-) | LVDS |
| 18 | RxIN3+ | LVDS CH3 data signal (+) | LVDS |
| 19 | GND | Ground | |
| 20 | LVDS_SET | LVDS_SET | 【Note1】 |

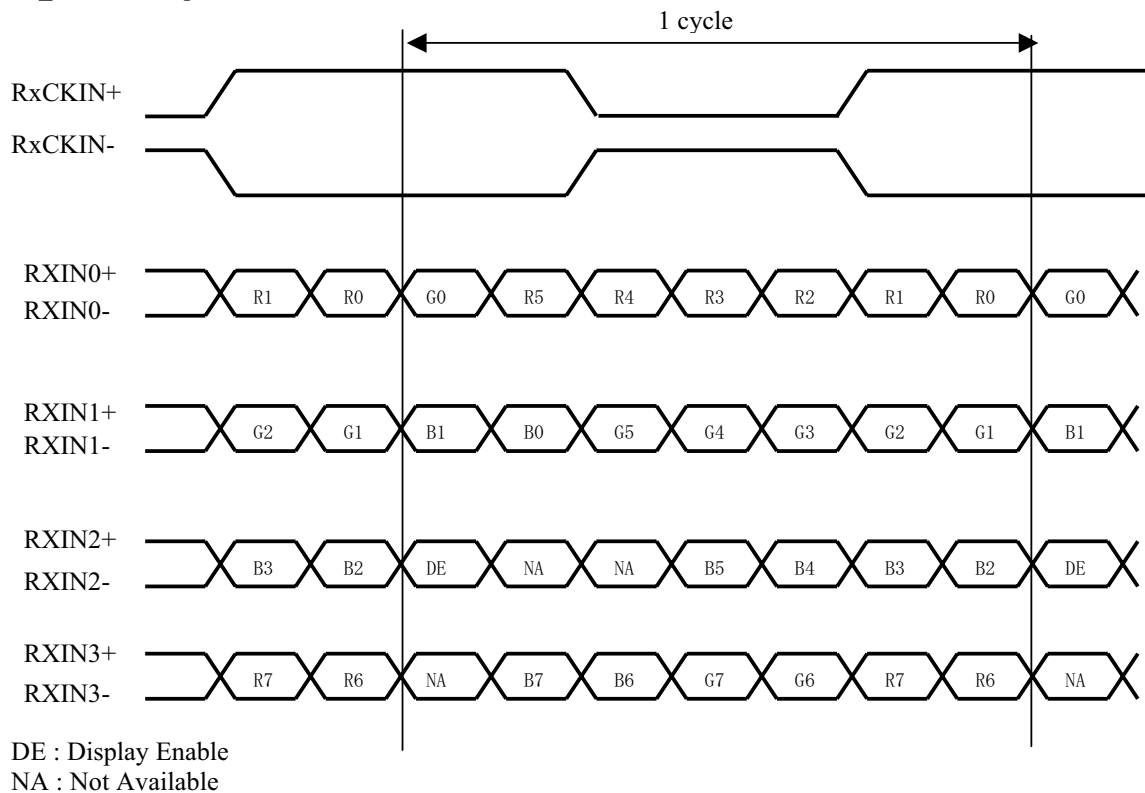
4-2 Data Mapping

1) 8 bit input

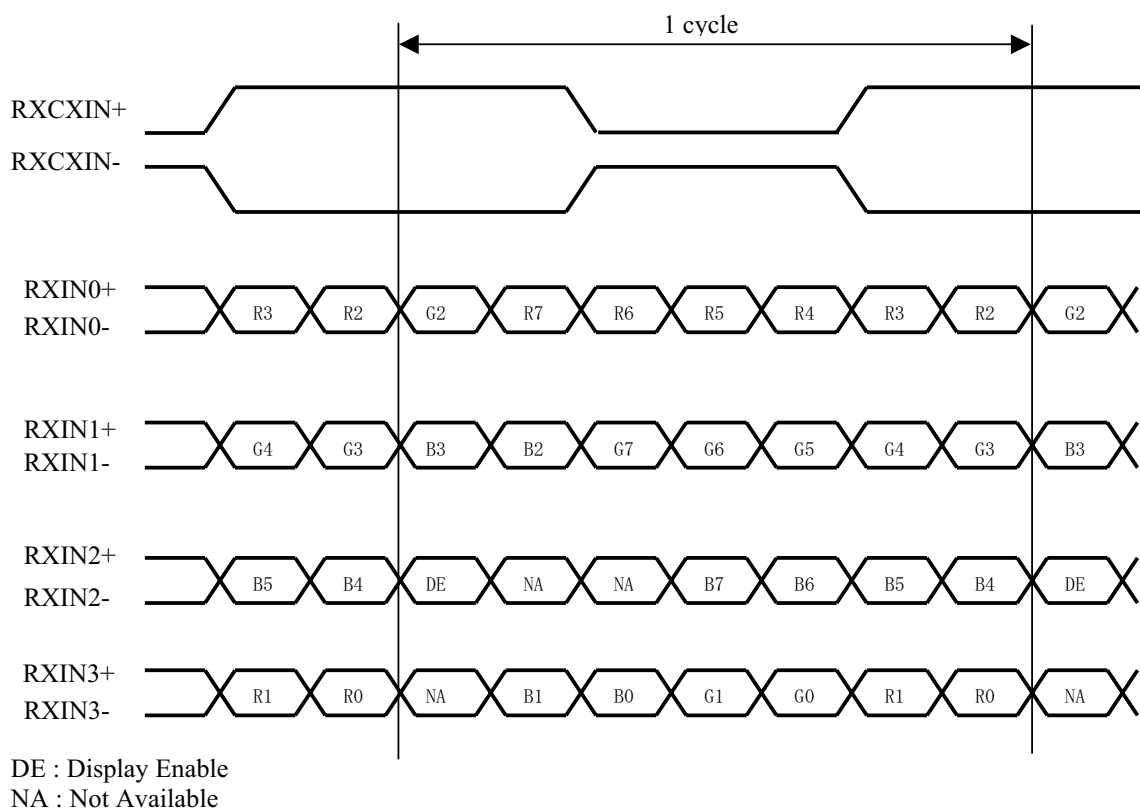
【Note1】 pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

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

<LVDS_SET=L or Open>



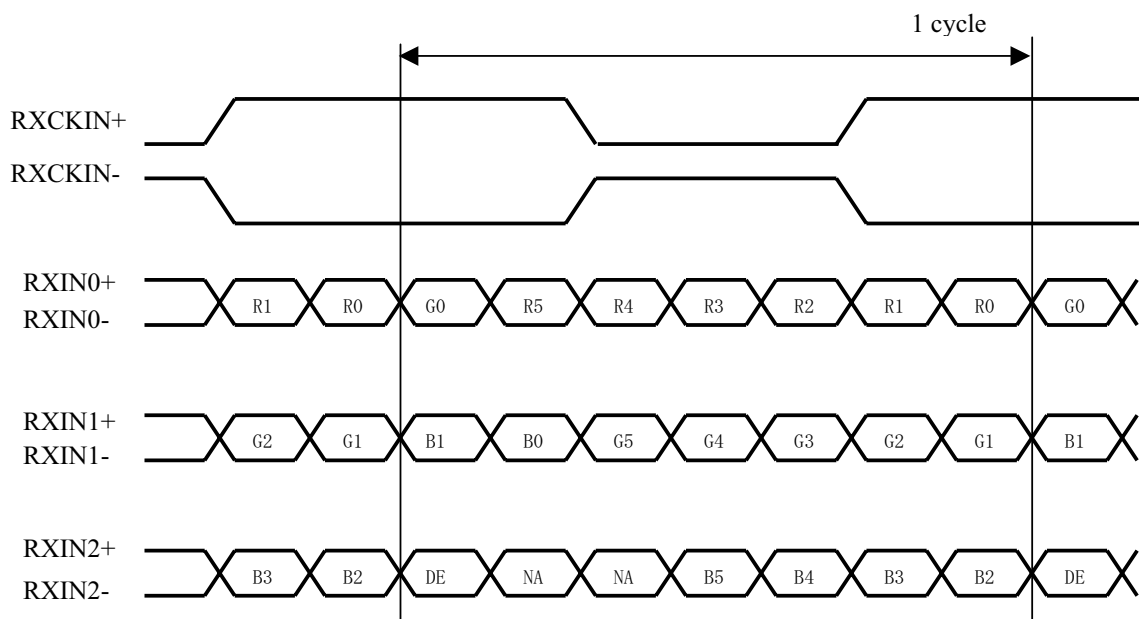
<LVDS_SET =H>



2) 6 bit input

【Note1】 pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

| Transmitter | | 20pin LVDS_SET | |
|-------------|------|------------------|-----------|
| Pin No | Data | =L (GND) or Open | =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 | — | (NA) |
| 28 | TC5 | — | (NA) |
| 30 | TC6 | — | DE |
| 50 | TD0 | — | GND |
| 2 | TD1 | — | GND |
| 8 | TD2 | — | GND |
| 10 | TD3 | — | GND |
| 16 | TD4 | — | GND |
| 18 | TD5 | — | GND |
| 25 | TD6 | — | (NA) |



DE : Display Enable

NA : Not Available

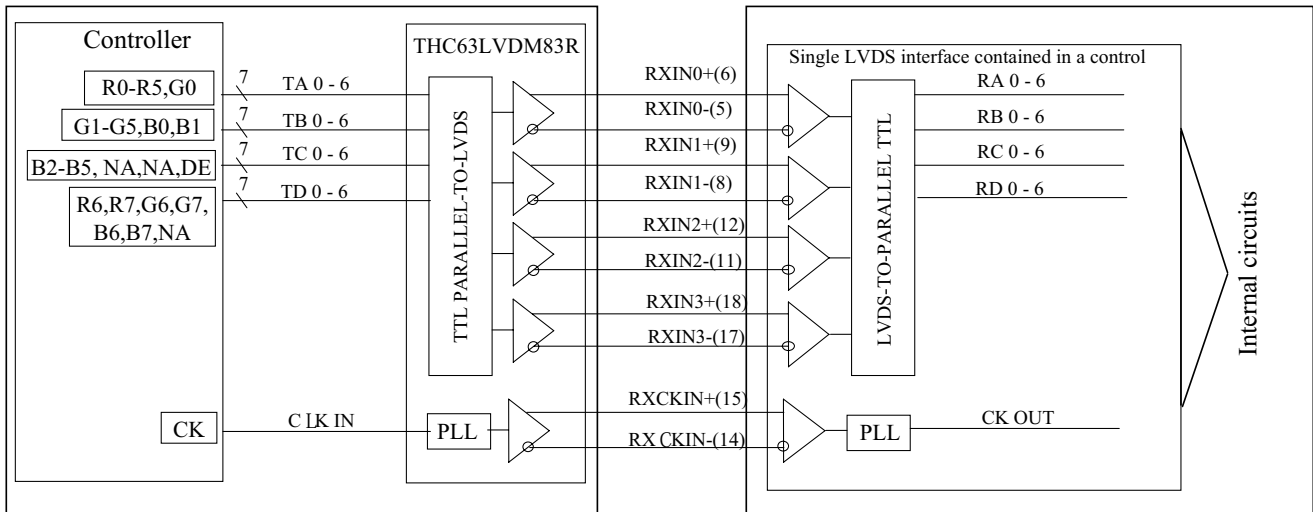
※In case of supplying 6 bit signal, it is recommended to connect pin No.17(RXIN3-) with H(3.3V), and No.18(RXIN3+) with L (GND).

(Computer Side)

(TFT-LCD side)

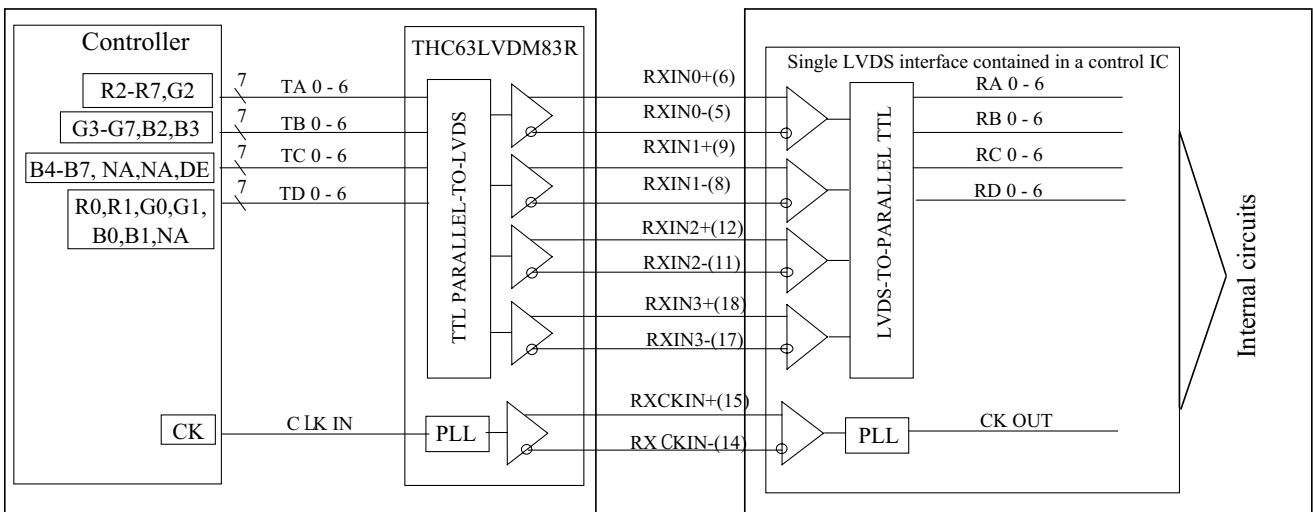
①8Bit Mode

LVDS_SET=L (20 pin=GND or OPEN)



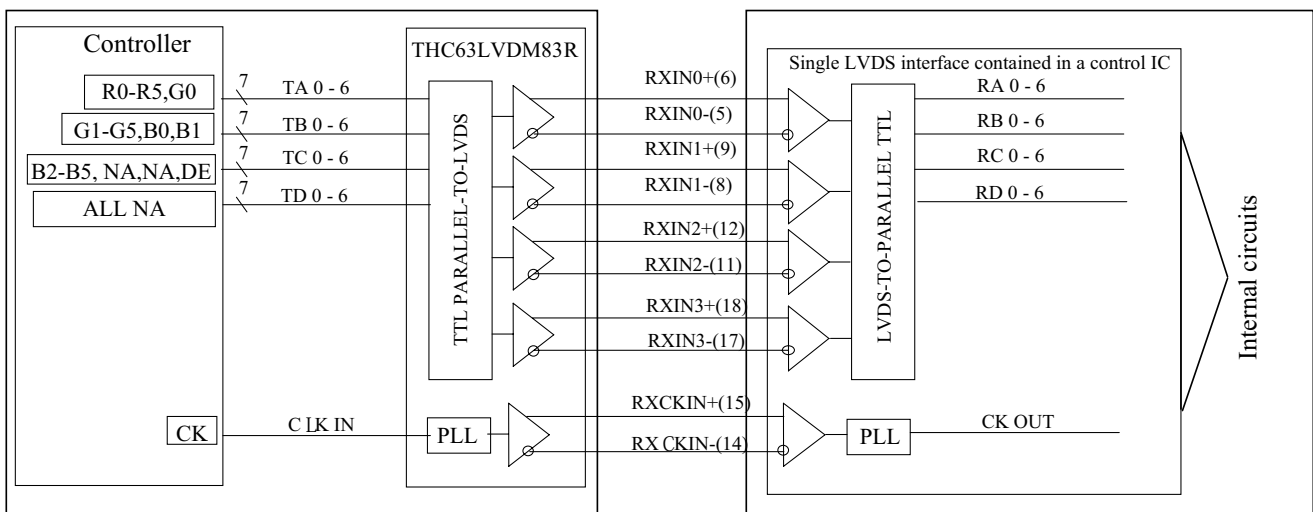
②8Bit Mode

LVDS_SET=H (20 pin=3.3[V])



③6Bit Mode

LVDS_SET=H (20 pin=3.3[V])



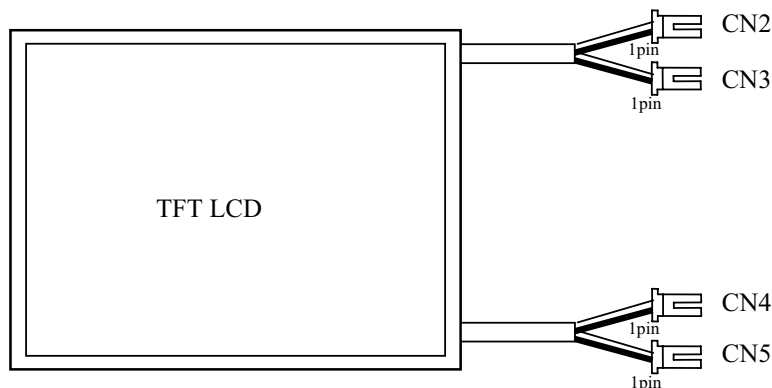
4-4. Backlight

CN 2, 3, 4, 5

The module-side connector : BHSR-02VS-1 (JST)

The user-side connector : SM02-BHSS-1-TB (JST)

| Pin no. | symbol | Function | I/O | Cable color |
|---------|------------|---|-----|----------------|
| 1 | V_{HIGH} | Power supply for lamp 1 (High voltage side) | I | Blue or Pink |
| 2 | V_{LOW} | Power supply for lamp 1 (Low voltage side) | I | Brown or White |



5. Absolute Maximum Ratings

5-1 module

| Parameter | Symbol | Condition | Applied pin | Ratings | Unit | Remark |
|-----------------------|------------|--------------------------|-------------------------------|--------------------------|--------------------|---------|
| Supply voltage | V_{CC} | $T_a=25^{\circ}\text{C}$ | V_{CC} | $-0.3 \sim +4.0$ | V | 【Note1】 |
| Lamp Input voltage | V_{HIGH} | — | — | $0 \sim +2000$ | V _{rms} | |
| Storage temperature | T_{STG} | — | — | $-30 \sim +70$ | $^{\circ}\text{C}$ | |
| Operating temperature | T_{OPA} | Panel surface | — | $0 \sim +60$ | $^{\circ}\text{C}$ | |
| Input voltage | V_{I1} | $T_a=25^{\circ}\text{C}$ | RxIN-/(i=0,1,2) RxCLKIN-/+ | $-0.3 \sim +0.3$ | V | |
| | V_{I2} | $T_a=25^{\circ}\text{C}$ | LVDS_SET | $-0.3 \sim V_{CC} + 0.3$ | V | |

【Note1】 Humidity : 95%RH Max. ($T_a \leq 40^{\circ}\text{C}$) Take care of static electricity.Maximum wet-bulb temperature at 39°C or less. ($T_a > 40^{\circ}\text{C}$) No condensation.

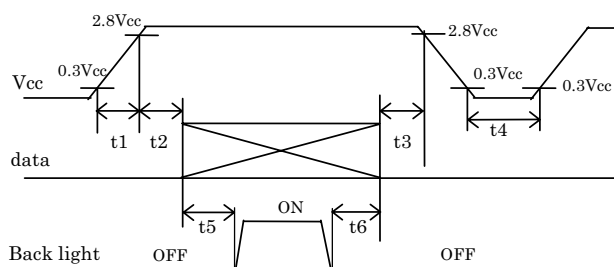
6. Electrical Characteristics

6-1. TFT-LCD panel driving

Ta=25°C

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--------------------------------------|---------------------|-----------------|------|------|------|-------|--|
| +3.3V | Supply voltage | V _{CC} | +3.0 | +3.3 | +3.6 | V | 【Note1】 |
| | Current dissipation | I _{CC} | — | 290 | 450 | mA | 【Note2】 |
| Permissive input ripple voltage | | V _{RF} | — | — | 100 | mVp-p | V _{CC} =+3.3V |
| Differential input threshold voltage | High | V _{TH} | — | — | 100 | mV | V _{CM} =+1.2V 【Note3】 |
| | Low | V _{TL} | -100 | — | — | mV | |
| Input current (High) | | I _{OH} | — | — | ±10 | μA | V _I =2.4V, V _{CC} =3.6V 【Note4】 |
| Input current (Low) | | I _{OL} | — | — | ±10 | μA | V _I =0V, V _{CC} =3.6V 【Note4】 |
| Terminal resistor | | R _T | — | 100 | — | Ω | Differential input |

【Note1】

On-off sequences of V_{CC} and data

$$0 < t1 \leq 10\text{ms}$$

$$0 < t2 \leq 10\text{ms}$$

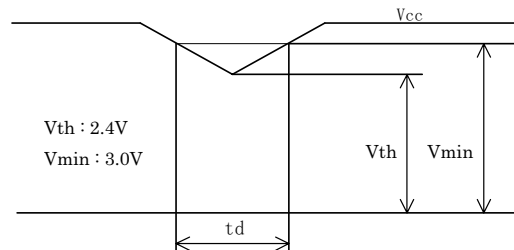
$$0 < t3 \leq 1\text{s}$$

$$1\text{s} \leq t4$$

$$200\text{ms} \leq t5$$

$$200\text{ms} \leq t6$$

Dip conditions for supply voltage



$$1) V_{th} \leq V_{CC} \leq V_{min}$$

$$t_d \leq 10\text{ms}$$

$$2) V_{CC} < V_{th}$$

V_{CC}-dip conditions should also follow the on-off conditions.

It is recommended to consider some timing difference between LVDS input and Backlight input as shown above.

If the Backlight lights on before LCD starting, or if the Backlight is kept on after LCD stopping, the screen may look white for a moment or abnormal image may be displayed. This is caused by variation in output signal from timing generator at LVDS input on or off. It does not cause the damage to the LCD module.

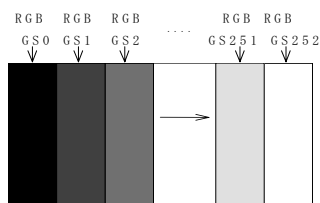
【Note2】 Typical current situation : 253-gray-bar pattern

V_{CC}=+3.3V, f_{ck}=65MHz, Ta=25°C

Gray scale : GS(n)

$$n=0 \sim 252$$

The explanation of each gray scale, GS(n), is described below section 8.

【Note3】 V_{CM} : LVDS Common mode voltage.【Note4】 V_I : Input voltage to LVDS_SET.

6-2. Backlight

The back light system is an edge-lighting type with four 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.

CCFT Model Name : KTBE222MSTF-320MA262-Z (STANLEY ELECTRIC CO., LTD.)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|------------------------|--------|--------|------|------|-------|--|
| Lamp current range | I_L | 3.5 | 6.0 | 7.5 | mArms | 【Note1】 |
| Lamp voltage | V_L | — | 625 | 720 | Vrms | $T_a=25^\circ\text{C}$, $I_L=6.0\text{mArms}$ |
| Lamp power consumption | P_L | — | 3.75 | 4.32 | W | 【Note2】 , $I_L=6.0\text{mArms}$ |
| Lamp frequency | F_L | 40 | 60 | 70 | kHz | 【Note3】 |
| Kick-off voltage | V_s | — | — | 1480 | Vrms | $T_a=0^\circ\text{C}$ 【Note4】 |
| Lamp life time | T_L | 50,000 | — | — | hour | 【Note5】 |

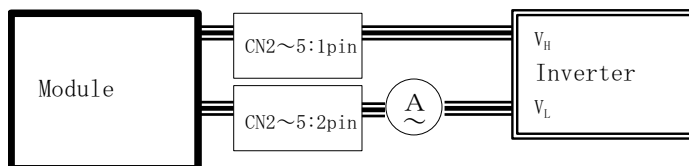
【Note1】 A lamp can be light in the range of lamp current shown above.

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.)

Lamp frequency : 40~70kHz

Ambient temperature : 0~50°C



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

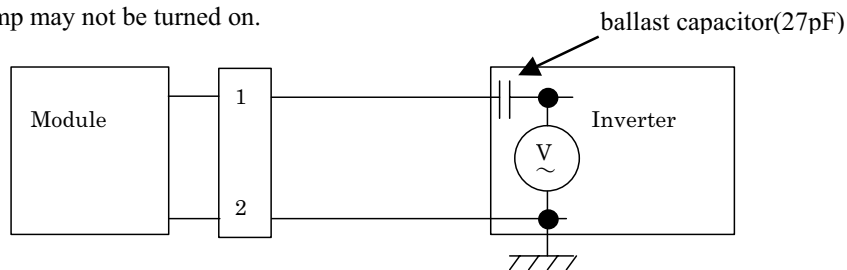
The data don't include loss at inverter.

【Note3】 Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

【Note4】 This is transformer output voltage at 27pF for the ballast capacitor of a DC-AC inverter.

The kick-off voltage may rise up in the user set, please decide the open output voltage by checking not to occur lighting failure under operating state.

The open output voltage should be applied to the lamp for more than 1 second to startup. Otherwise the lamp may not be turned on.



* 2pin V_{LOW}

【Note5】 Above value is applicable when lamp (the long side of LCD module) is placed horizontally.

(Landscape position)

Lamp life time is defined as the time when either ① or ② occurs in the continuous operation under the condition of $T_a=25^\circ\text{C}$ and $I_L=6.0\text{mA rms}$.

① Brightness becomes 50% of the original value under standard condition.

② Kick-off voltage at $T_a=0^\circ\text{C}$ exceeds 1480 V_{rms} value.

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

《Note》

The performance of the backlight, for example lifetime 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 occurs. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Use the lamp inverter power source incorporating such safeguard as overvoltage / overcurrent protective circuit or lamp voltage waveform detection circuit, which should have individual control of each lamp.

In case one circuit without such individual control is connected to more than two lamps, excessive current may flow into one lamp when the other one is not in operation.

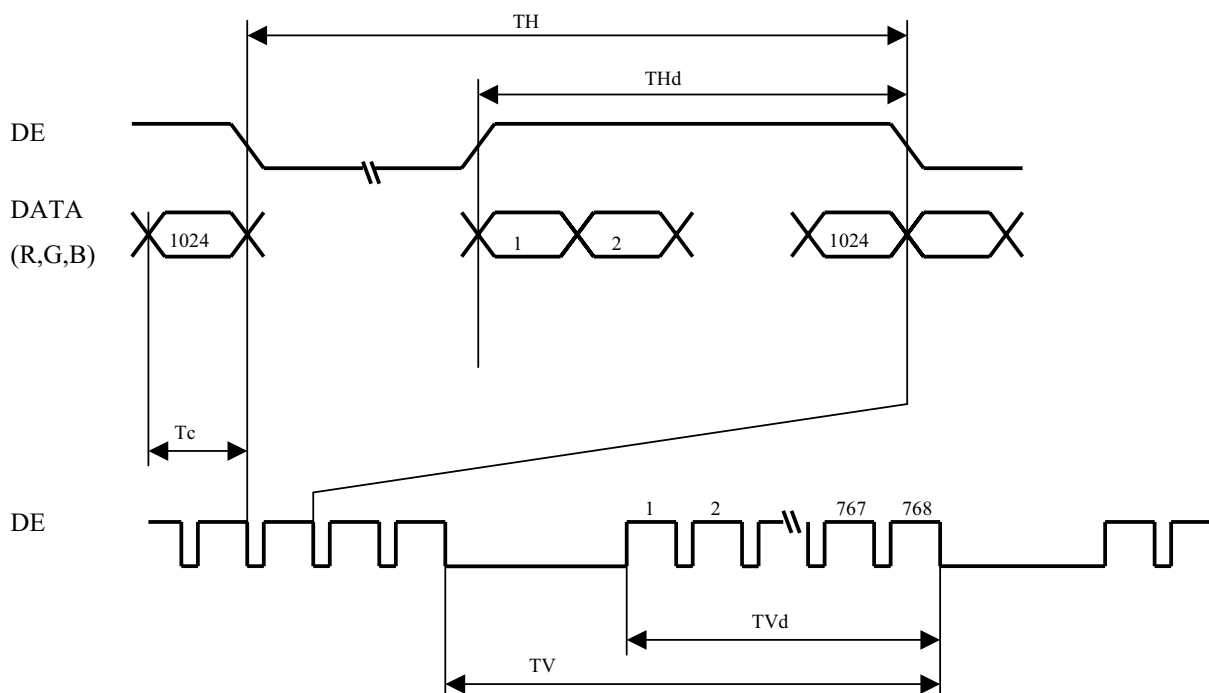
Under the environment of 10lx or less, miss-lighting or lighting delay may occur.

7. Timing characteristics of input signals

7-1-1. Timing characteristics

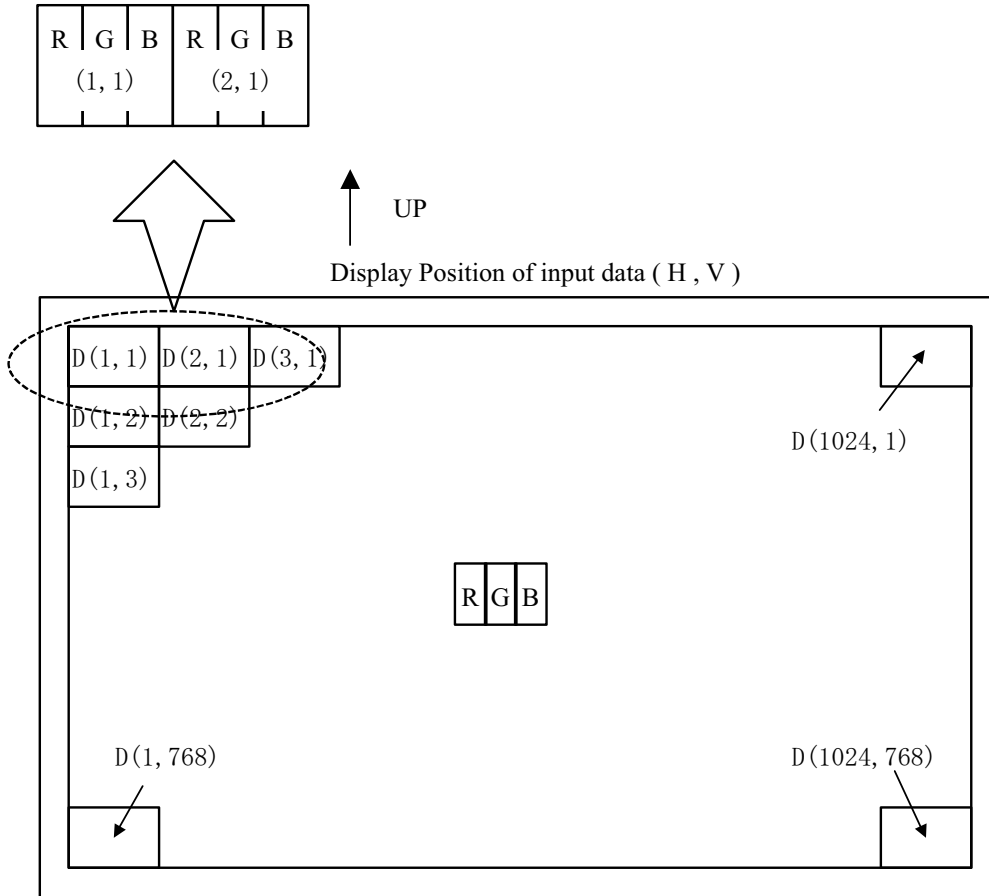
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--------------------------|--------|------|------|------|-------|---------|
| Frequency | 1/Tc | 50.0 | 65.0 | 80.0 | MHz | |
| Horizontal period | TH | 1056 | 1344 | 1720 | clock | |
| | | 16.0 | 20.7 | 23.4 | μs | |
| Horizontal period (High) | THd | 1024 | 1024 | 1024 | clock | |
| Vertical period | TV | 773 | 806 | 990 | line | 【Note1】 |
| | | 13.3 | 16.7 | 18.0 | ms | |
| Vertical period (High) | TVd | 768 | 768 | 768 | line | |

【Note1】 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.



7-2 Input Data Signals and Display Position on the screen

Graphics and texts can be displayed on a $1024 \times \text{RGB} \times 768$ dots panel with 16M colors by supplying 24 bit data signal (8bit/color [253 gray scales] $\times 3$).



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

8-1. 8bit input

| | Colors & Gray scale | Gray Scale | Data signal | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|---------------------|------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | | | 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 | |
| | Blue | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 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 | |
| | Cyan | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 1 | 1 | 1 | 1 | 1 | 1 | X | X | 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 | |
| | Magenta | — | X | X | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 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 | |
| | White | — | X | X | 1 | 1 | 1 | 1 | 1 | 1 | X | X | 1 | 1 | 1 | 1 | 1 | 1 | X | X | 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 | | |
| | ↑ | GS1 | 1 | 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 | | |
| | ↑ | ↓ | | | | | | ↓ | | | | | | | | | ↓ | | | | | | ↓ | | | |
| | ↓ | ↓ | | | | | | ↓ | | | | | | | | | ↓ | | | | | | ↓ | | | |
| | Brighter | GS250 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 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 | | |
| | Red | GS252 | X | X | 1 | 1 | 1 | 1 | 1 | 1 | 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 | | |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | | |
| | ↑ | ↓ | | | | | | ↓ | | | | | | | | | | | | | | | ↓ | | | |
| | ↓ | ↓ | | | | | | ↓ | | | | | | | | | | | | | | | ↓ | | | |
| | Brighter | GS250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 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 | | |
| | Green | GS252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 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 | 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 | | |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | | |
| | ↑ | ↓ | | | | | | ↓ | | | | | | | | | | | | | | | ↓ | | | |
| | ↓ | ↓ | | | | | | ↓ | | | | | | | | | | | | | | | ↓ | | | |
| | Brighter | GS250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 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 | | |
| | Blue | GS252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | 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.

8-2 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.

9. Optical Characteristics

Ta=25°C, Vcc =+3.3V

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|-----------------------|------------|----------------------------|--------------------|-------|-------|-------|-------------------|---------------------------------|
| Viewing angle range | Vertical | θ_{11} | $CR \geq 5$ | 40 | 55 | — | Deg. | |
| | | θ_{12} | | 70 | 80 | — | Deg. | |
| | Horizontal | θ_{21}, θ_{22} | | 70 | 80 | — | Deg. | |
| | Vertical | θ_{11} | $CR \geq 10$ | 30 | 45 | — | Deg. | |
| | | θ_{12} | | 45 | 55 | — | Deg. | |
| | Horizontal | θ_{21}, θ_{22} | | 50 | 60 | — | Deg. | |
| Contrast ratio | | C R | $\theta = 0^\circ$ | 250 | 350 | — | — | 【Note2,4】 |
| Response time | | $\tau_d + \tau_r$ | $\theta = 0^\circ$ | — | 30 | 60 | ms | 【Note3,4】 |
| Chromaticity of White | Wx | $\theta = 0^\circ$ | $\theta = 0^\circ$ | 0.283 | 0.313 | 0.343 | — | 【Note4】 |
| | Wy | | | 0.299 | 0.329 | 0.359 | — | |
| Chromaticity of Red | Rx | $\theta = 0^\circ$ | $\theta = 0^\circ$ | 0.551 | 0.581 | 0.611 | — | |
| | Ry | | | 0.292 | 0.322 | 0.352 | — | |
| Chromaticity of Green | Gx | $\theta = 0^\circ$ | $\theta = 0^\circ$ | 0.277 | 0.307 | 0.337 | — | |
| | Gy | | | 0.516 | 0.546 | 0.576 | — | |
| Chromaticity of Blue | Bx | $\theta = 0^\circ$ | $\theta = 0^\circ$ | 0.121 | 0.151 | 0.181 | — | |
| | By | | | 0.097 | 0.127 | 0.157 | — | |
| Luminance of white | | YL | $\theta = 0^\circ$ | 500 | 600 | — | cd/m ² | IL=6.0mArms, f=60kHz 【Note4】 |
| White Uniformity | | δw | $\theta = 0^\circ$ | — | — | 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.

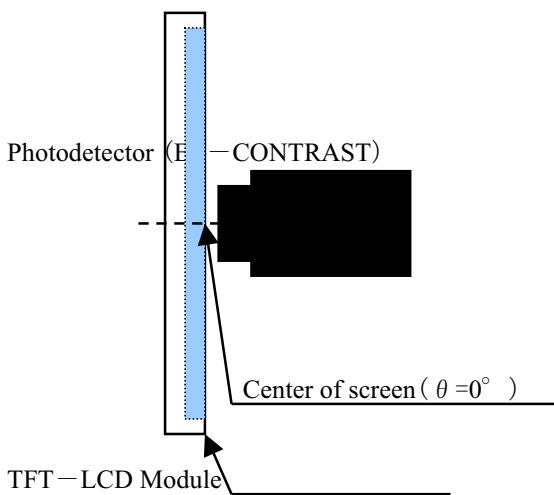


Fig2-1 Viewing angle measurement method

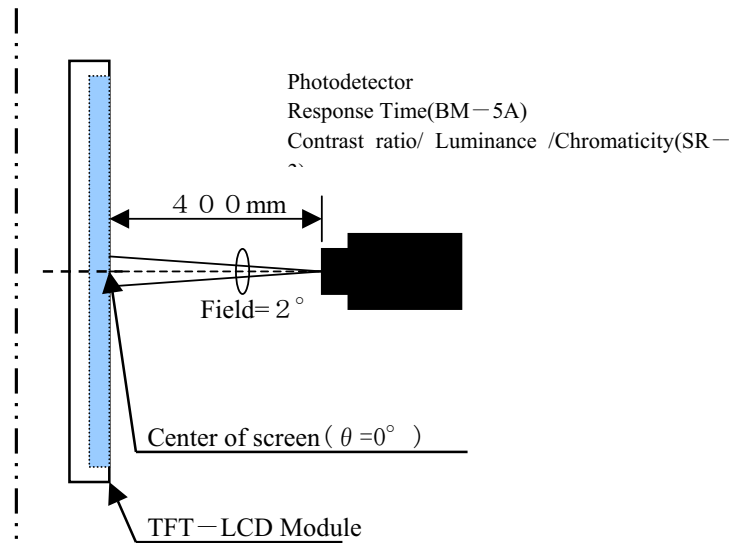
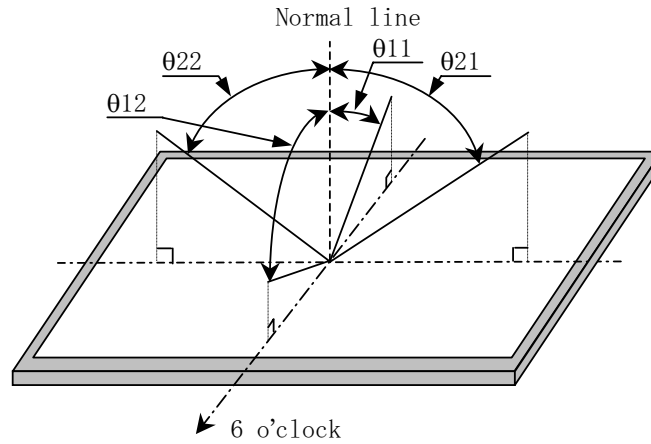


Fig2-2 Luminance/Contrast ratio/Response time/Chromaticity measurement method

Fig2 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



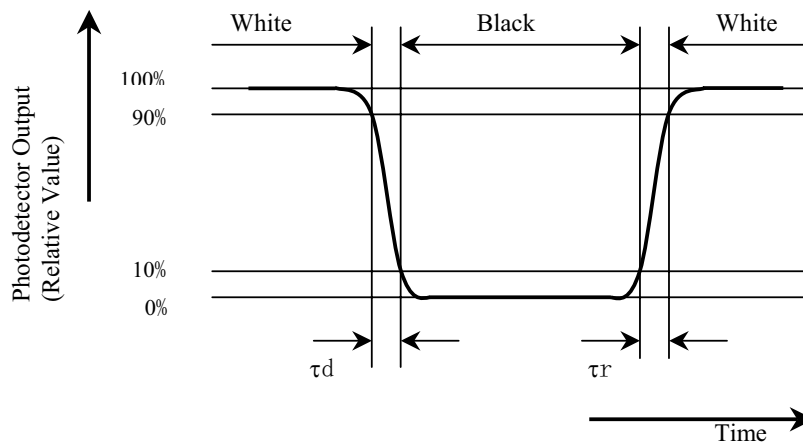
【Note2】 Definition of contrast ratio:

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:

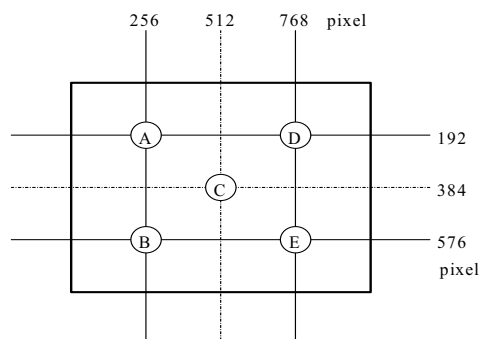
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



【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).



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

10. 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 polarize is easily damaged, pay attention not to scratch it.
- d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- 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 take the human earth into consideration when handling.
- h) Make sure the four mounting holes of the module are grounded sufficiently. Take electro-magnetic interference (EMI) into consideration.
- i) The module has some printed circuit boards (PCBs) on the back side. Take care to keep them from any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
- j) Observe all other precautionary requirements in handling components.
- k) Since it is necessary to remove the screw on the back of a module before performing lamp exchange, please take a cabinet design into consideration.
- l) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc. So, please avoid such design.
- m) When handling LCD modules and assembling them into cabinets, please be noted that long-term 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 LCD modules.

11. Packing form

- a) Piling number of cartons : maximum 5 cartons
- b) Packing quantity in one carton : 5 module
- c) Carton size : 319mm(W) × 402mm(D) × 280mm(H)
- d) Total mass of one carton filled with full modules : 8.0kg.Max
- e) Packing form is shown in Fig.3

12. Reliability test items

| No | Test item | Conditions | |
|----|---|--|-------------------|
| 1 | High temperature storage test | Ta = 70°C 240H | |
| 2 | Low temperature storage test | Ta = -30°C 240H | |
| 3 | High temperature & high humidity operation test | Ta = 40°C , 95%RH 240H (No condensation) | |
| 4 | High temperature operation test | Tp = 60°C 240H (Tp: The temperature of panel surface) | |
| 5 | Low temperature operation test | Tp = 0°C 240H | |
| 6 | Vibration test | Waveform : Sine wave Frequency : 10~57Hz/Vibration width (one side) : 0.075mm : 58~500Hz/Gravity : 9.8m/s ² Sweep time : 11minutes Test period : 3 hours (1 hour for each direction of X,Y,Z) | 【Note】 |
| 7 | Shock test | Max. gravity : 490m/s ² Pulse width : 11ms, sine wave Direction : ±X, ±Y, ±Z, once for each direction. | 【Note】 |
| 8 | Thermal shock test (non- operating) | Ta=-30°C~70°C ; 5 cycles Test period : 10 hours (1 hour for each temperature) | |
| 9 | Altitude | Ta=50°C,70kPa,3,048m(10,000ft), t=24H (Operating) Ta=70°C,12kPa,15,240m(50,000ft), t=24H (Storage) | |
| 10 | ESD test | Contact discharge (150pF 330Ω) non-operating = ±10kV, operating = ±8kV Atmospheric discharge (150pF 330Ω) non-operating = ±20kV, operating = ±15kV | |
| 11 | EMI | Measurement in 10m site Display position on the screen = "H" (full-screen), GND to 4 place = un-connect, Vcc / Vsignal = typ. | VCCI (Class B) |

【Note】

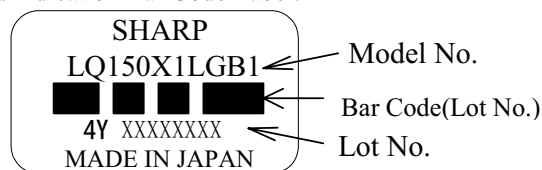
A gap of panel shall not occur by vibration or the shock.

【Result Evaluation Criteria】

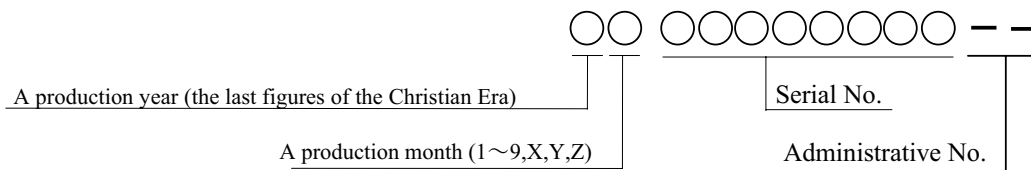
Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

13. Others

1) Lot No. and indication Bar Code Label:



How to express Lot No.



2) Packing Label

| | |
|-------------------------------|---------------------|
| 社内品番：(4 S) LQ150X1LGB1 | |
| Bar code ① | |
| Lot NO. | :(1 T) 2004. 11. 01 |
| Bar code ② | |
| Quantity : (Q) | p c s |
| Bar code ③ | |
| ユーザ品番 | : |
| シャープ物流用ラベルです。 | |

① Model No. (LQ150X1LGB1)

② Lot No. (Date)

③ Quantity

3) 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.

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

5) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

6) The chemical compound which causes the destruction of ozone layer is not being used.

7) Warning of mercury and material information of LPG (Light Pipe Guide) are labeled on the back of the module.

| |
|--|
| <p style="text-align: center;">MATERIAL INFORMATION</p> <p style="text-align: center;">>PLASTIC LIGHT GUIDE:PMMA<</p> |
|--|

8) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury, Please follow local ordinances or regulations for disposal. (put on the back of the module.)

| |
|--|
| <p>COLD CATHODE FLUORESCENT LAMP IN LCD PANEL CONTAINS A SMALL AMOUNT OF MERCURY, PLEASE FOLLOW LOCAL ORDINANCES OR REGULATION FOR DISPOSAL 当該液晶ディスプレイパネルは蛍光管が組み込まれていますので、地方自治体の条例、または、規則に従って廃棄ください。</p> |
|--|

9) This specification document's Japanese language version is also available. Its Number (SPEC.No.) is LD-16Y03.

10) When any question or issue occurs, it shall be solved by mutual discussion.

14. Carton storage condition

| | |
|-----------------------|--|
| Temperature | 0°C to 40°C |
| Humidity | 95%RH or less |
| Reference condition : | 20°C to 35°C , 85%RH or less (summer) |
| | : 5°C to 15°C , 85%RH or less (winter) |
| | • the total storage time (40°C,95%RH) : 240H or less |
| Sunlight | Be sure to shelter a product from the direct sunlight. |
| Atmosphere | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected. |
| Notes | Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment |
| Storage period | 1 year |

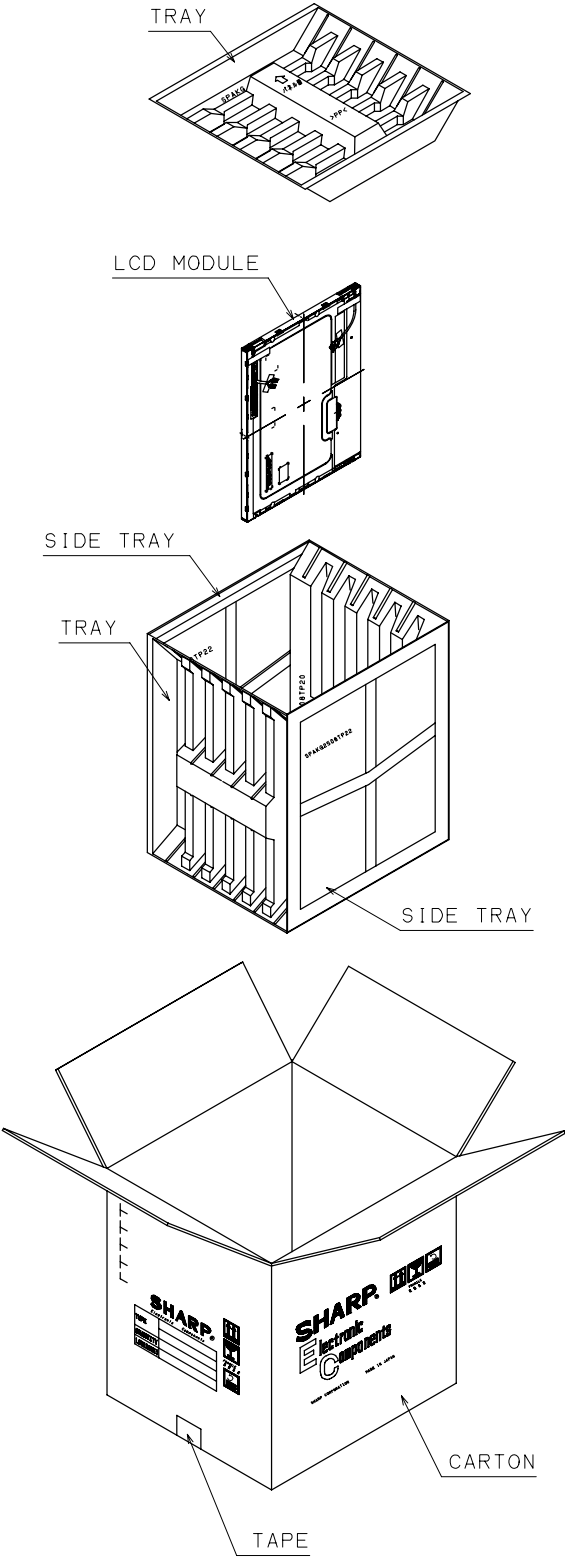


Fig. 3: PACKING FORM

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