

Technical Literature for Sharp LQ057Q3DC12

Preliminary Version Dec 2004

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1. Application

This specification applies to color TFT-LCD module, LQ057Q3DC12.

2. Summary and Features

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 (PWB), FPC, front and back polarizer, sealed case, backlight unit. Graphics and texts can be displayed on a $320 \times \text{RGB} \times 240$ dots panel with 262,144 colors by suitable control supplying from the outside.

It isn't composed DC/AC inverter for a backlight drive.

- The input of QVGA and VGA signal is possible.
- Wide Viewing Angle technology is adopted. (The most suitable viewing angle is in the 12 o'clock direction.)
- By adopting an active matrix drive, a picture with high contrast is realized.
- Reflection due to external light is minimized through the use of a low reflection black matrix.
- A thin, light and compact module is accomplished through the use of COG mounting technology.
- Through the use of high color purity color filter and TN-normally white mode excelled in color reproducibility, an image with highly natural color reproduction is realized.
- High viewing angle and high brightness (500cd/m²).
- An inverted video display in the vertical / horizontal directions is possible.

3. Mechanical specifications

table 3-1

| Parameter | Specifications | Units |
|---|---|--------|
| Screen size | 14.4 (5.7 inch) diagonal | cm |
| Active area | 115.2 (H) × 86.4 (V) | mm |
| Display format | 320(H) × 240(V) (1 pixel = R + G + B dots) | pixels |
| Dot pitch | 0.360 (H) × 0.360 (V) | mm |
| Pixel configuration | R,G,B Stripe configuration | |
| Display mode | Normally white | |
| Outline dimension 【Note1-1】 | 144.0 (W) × 104.6 (H) × 13.0(D) | mm |
| Mass | (220 ± 20) | g |
| Surface treatment (Surface hardness) | Hard coat (3H) | |

【Note 1-1】

A connector of backlight is excepted.

A figure of outline dimension is shown in Fig. 1.

4. Input terminal

4-1. TFT-LCD panel driving part

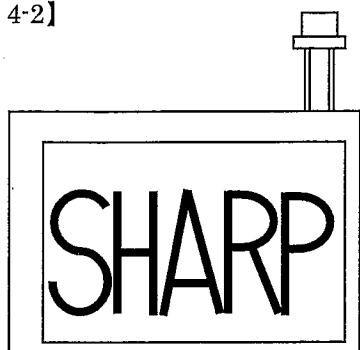
CN1 Used connector: FH12-33S-0.5SH (HIROSE ELECTRIC CO., LTD.)

Table 4-1 Functional table of CN1 terminals

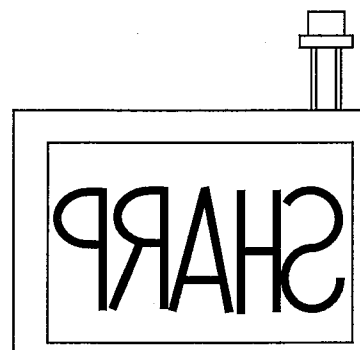
| Pin No. | Symbol | Description | Polarity |
|---------|--------|---|----------|
| 1 | GND | ground | |
| 2 | CK | Clock signal for sampling each data signal | |
| 3 | Hsync | Horizontal synchronous signal | Negative |
| 4 | Vsync | Vertical synchronous signal | Negative |
| 5 | GND | ground | |
| 6 | R0 | RED data signal(LSB) | |
| 7 | R1 | RED data signal | |
| 8 | R2 | RED data signal | |
| 9 | R3 | RED data signal | |
| 10 | R4 | RED data signal | |
| 11 | R5 | RED data signal(MSB) | |
| 12 | GND | ground | |
| 13 | G0 | GREEN data signal(LSB) | |
| 14 | G1 | GREEN data signal | |
| 15 | G2 | GREEN data signal | |
| 16 | G3 | GREEN data signal | |
| 17 | G4 | GREEN data signal | |
| 18 | G5 | GREEN data signal(MSB) | |
| 19 | GND | ground | |
| 20 | B0 | BLUE data signal(LSB) | |
| 21 | B1 | BLUE data signal | |
| 22 | B2 | BLUE data signal | |
| 23 | B3 | BLUE data signal | |
| 24 | B4 | BLUE data signal | |
| 25 | B5 | BLUE data signal(MSB) | |
| 26 | GND | ground | |
| 27 | ENAB | Signal to settle the horizontal display position 【Note4-1】 | Positive |
| 28 | Vcc | +3.3V power supply | |
| 29 | Vcc | +3.3V power supply | |
| 30 | R/L | Selection signal for horizontal scanning direction 【Note4-2】 ("L" : Normally, "H" : Right-and-Left reversal) | |
| 31 | U/D | Selection signal for vertical scanning direction 【Note4-2】 ("H" : Normally, "L" : Up-and-Down reversal) | |
| 32 | V/Q | Selection signal for VGA or QVGA ("H" : VGA, "L" : QVGA) | |
| 33 | GND | ground | |

【Note 4-1】 The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in Fig7. Don't keep ENAB "High" during operation.

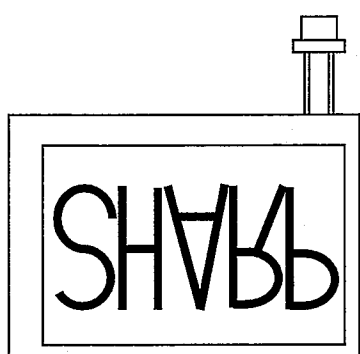
【Note 4-2】



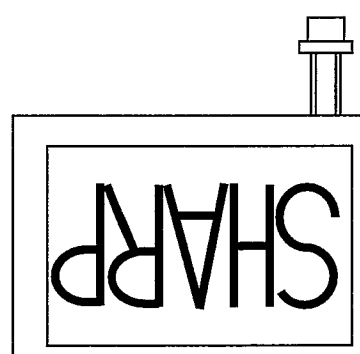
R/L = L, U/D = H



R/L = H, U/D = H



R/L = L, U/D = L



R/L = H, U/D = L

4-2. Backlight fluorescent tube driving part

CN2 Used connector : BHR-02(8.0)VS-1N (JST Co., Ltd.)

Suitable connector : SM02(8.0)B-BHS-1N-TB (JST Co., Ltd.)

Table 4-2 Functional table of CN2 terminals

| Terminal No. | symbol | function | Color of FL cable |
|--------------|-------------------|------------------------------------|-------------------|
| 1 | V _{LOW} | input terminal (Low Voltage Side) | White |
| 2 | NC | Non connection | — |
| 3 | V _{HIGH} | input terminal (High Voltage Side) | Red |

5. Absolute maximum ratings

Table 5-1

| Parameter | Symbol | Condition | Ratings | Unit | Note |
|--|-------------------|----------------------|--------------|------|----------------|
| Input voltage | V _I | T _a =25°C | -0.3 ~ +6.0V | V | 【Note 5-1】 |
| +3.3V power supply voltage | V _{CC} | T _a =25°C | 0 ~ +4.0 | V | |
| Storage temperature | T _{stg} | — | -30 ~ +80 | °C | 【Note 5-2,3】 |
| Operating temperature (Panel surface temperature) | T _{opr1} | — | -10 ~ +70 | °C | 【Note 5-2,3,4】 |
| Operating temperature (Ambient temperature) | T _{opr2} | — | -10 ~ +70 | °C | 【Note 5-5】 |

【Note 5-1】 CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D, V/Q

【Note 5-2】 This rating applies to all parts of the module and should not be exceeded.

【Note 5-3】 Maximum wet-bulb temperature is less than 39°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

【Note 5-4】 The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, judgment is done using the ambient temperature T_a = +25°C.

【Note 5-5】 Ambient temperature when the backlight is lit (reference value).

6. Electrical characteristics

6-1. TFT-LCD panel driving section

Table 6-1

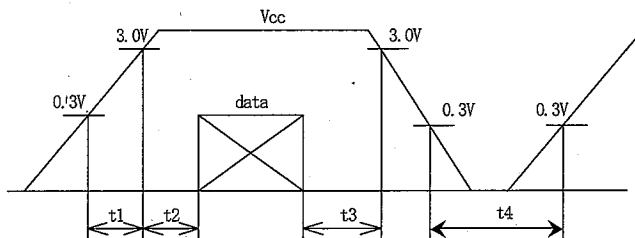
Ta=25°C

| Parameter | Symbol | MIN | TYP | MAX | Unit | Remarks | |
|---------------------------|---------------------|--------|------|--------|------------------|--|------------|
| +3.3V power supply | Supply voltage | Vcc | +3.0 | +3.3 | +3.6 | V | 【Note 6-1】 |
| | Current dissipation | Icc | — | (140) | — | mA | 【Note 6-2】 |
| Permissible input ripple | V _{RF} | — | — | 100 | MV _{pp} | Vcc=+3.3V | |
| Input Low voltage | V _{IL} | 0 | — | 0.3Vcc | V | 【Note 6-3】 | |
| Input High voltage | V _{IH} | 0.7Vcc | — | +5.5 | V | | |
| Input leak current (Low) | I _{OL} | — | — | 10 | μA | V _I =0V 【Note 6-3】 | |
| Input leak current (High) | I _{OH1} | — | — | 10 | μA | V _I =3.3~5.0V 【Note 6-4】 | |
| | I _{OH2} | — | — | 100 | μA | V _I =3.3~5.0V 【Note 6-5】 | |

【Note 6-1】

Vcc turn-on/off conditions.

- t1 ≤ 20ms
- 0 < t2 ≤ 50ms
- 0 < t3 ≤ 1s
- 1s < t4



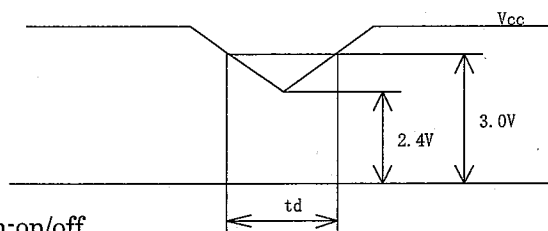
Vcc-dip conditions

- 1) 2.4V < Vcc < 3.0V

t_d ≤ 20msec

- 2) At Vcc < 2.4V

Vcc-dip conditions should also follow the Vcc turn-on/off conditions.

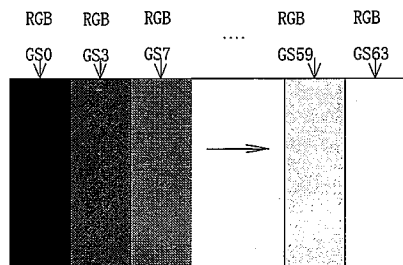


【Note 6-2】 Vcc = 3.3V, V/Q = "L"

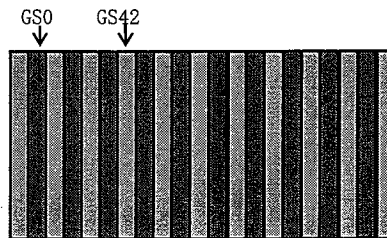
Typical current situation: Timing; Typical, 64-gray-bar pattern.

Max current situation: Timing; Typical, Vertical stripe pattern alternating

0 gray scale (GS0) with 42 gray scale (GS42) every 1 dot.



Typical current situation



Max current situation

【Note 6-3】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,R/L,U/D,V/Q

【Note 6-4】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,R/L,U/D

【Note 6-5】 ENAB, V/Q

6-2. Backlight driving section

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube). The characteristics of Lamp are shown in the following table.

Table 6-2

| Parameter | Symbol | MIN | TYP | MAX | Unit | Remarks |
|------------------|----------|-------|-------|-------|-------|-------------------------------|
| lamp voltage | VL | (620) | (690) | (760) | Vrms | IL = 5 mArms |
| lamp current | IL | (4.5) | (5.0) | (5.5) | mArms | ordinary state |
| lamp power | WL | — | (3.5) | — | W | ratings |
| lamp frequency | fL | (30) | — | (60) | kHz | |
| kick-off voltage | Ta=+25°C | VS | — | — | Vrms | A shield is connected to GND. |
| | Ta=-10°C | | — | — | | |
| | | | | | | (1470) |

(Inverter : HIU-288 [Output condenser : 22pF] TOSHIBA HARISON LIGHTING co. Ltd.)

【Caution】

Use the inverter providing symmetrical sine-wave in positive/negative polarity with no spike. A shield(module's metal shield) should be connected to GND of inverter circuit.

7. Timing Characteristics of input signals

Timing diagrams of input signal are shown in Fig.7

7-1. Timing characteristics

Table 7-1

| Parameter | Symbol | MIN | TYP | MAX | Unit | Remarks | |
|---------------------------------|-------------|------|------|--------|-------|---------|---------|
| Clock | frequency | 1/Tc | — | 25.18 | 28.33 | MHz | V/Q = H |
| | | | — | 6.3 | 7.0 | | V/Q = L |
| | Duty ratio | TH/T | 40 | 50 | 60 | % | |
| Data | Setup time | Tds | 5 | — | — | ns | |
| | Hold time | Tdh | 10 | — | — | ns | |
| Horizontal sync. signal | Cycle | TH | 30.0 | 31.8 | — | μs | V/Q = H |
| | | | 770 | 800 | 900 | clock | |
| | Pulse width | THp | 50.0 | 63.6 | — | μs | V/Q = L |
| | | | 360 | 400 | 450 | clock | |
| Vertical sync. signal | Cycle | TV | 515 | 525 | 560 | line | V/Q = H |
| | | | 251 | 262 | 280 | | V/Q = L |
| | Pulse width | TVp | — | — | 34 | line | |
| Horizontal display period | THd | 320 | 320 | 320 | clock | | |
| Hsync-Clock phase difference | THc | 10 | — | Tc-10 | ns | | |
| Hsync-Vsync phase difference | TVh | 0 | — | TH-THp | μs | | |
| Vertical display start position | TVs | 34 | 34 | 34 | line | V/Q = H | |
| | | 7 | 7 | 7 | | V/Q = L | |

Note) In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.

7-2. Horizontal display position

The horizontal display position is determined by the rising edge of ENAB signal.

Table 7-2

| Parameter | symbol | Min. | Typ. | Max. | Unit | Remark |
|--------------------------------------|-------------|------|------|--------|-------|---------|
| Enable signal | Setup time | Tes | 5 | — | Tc-10 | ns |
| | Pulse width | Tep | 2 | 320 | TH-10 | clock |
| Hsync-Enable signal phase difference | The | 44 | — | TH-664 | clock | V/Q = H |
| | | 2 | | TH-340 | | V/Q = L |

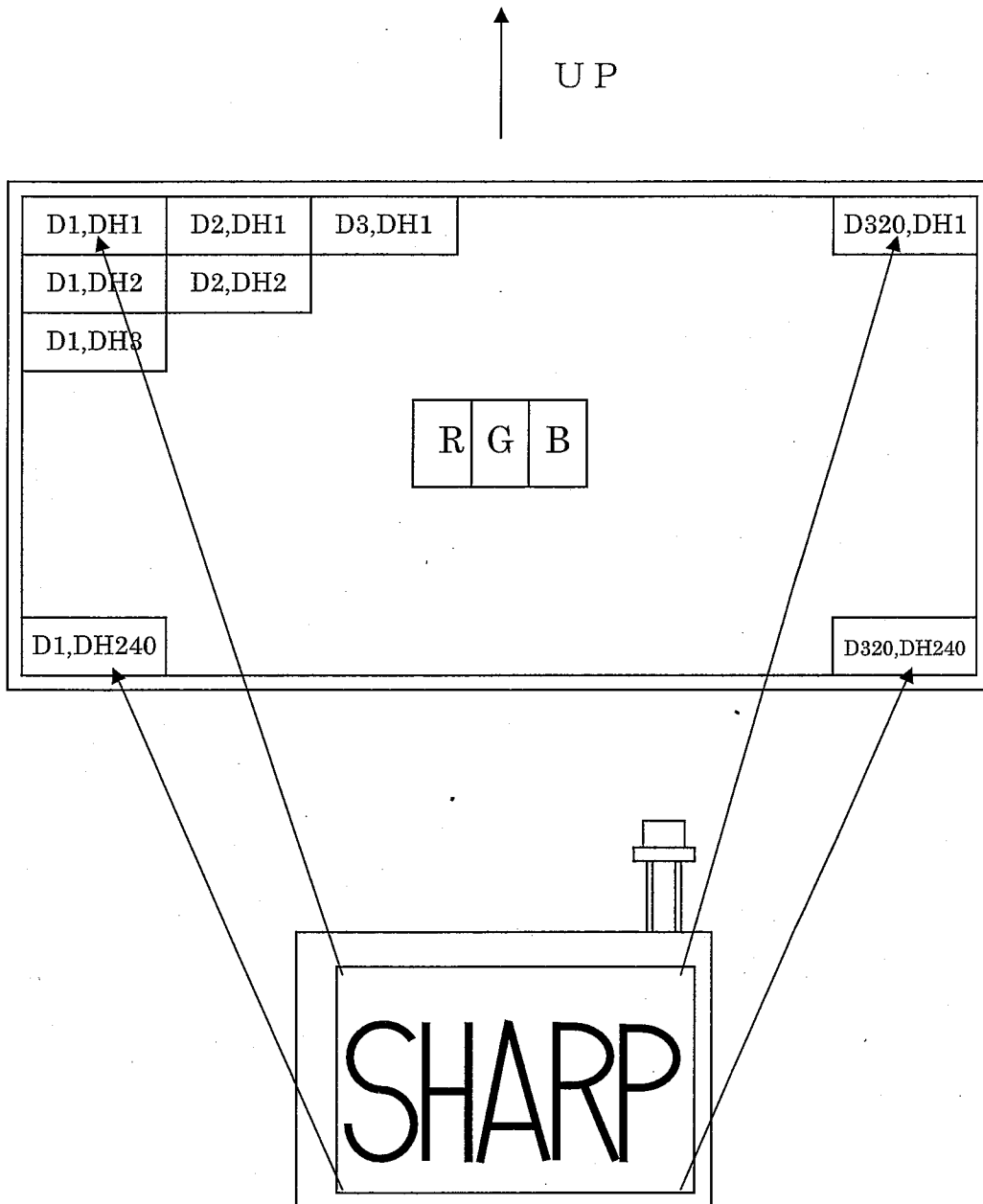
Note) When ENAB is fixed "Low", the display starts from the following data as shown in Fig.7.

V/Q = "H" C104 (clock) V/Q = "L" C52 (clock)

7-3. Vertical display position

The Vertical display start position (TVs) is fixed 34 line (V/Q = H) and 7 line (V/Q = L).
 ENAB signal has no relation to the vertical display position.

7-4. Input Data Signals and Display Position on the screen



Display position of input data (H,V)

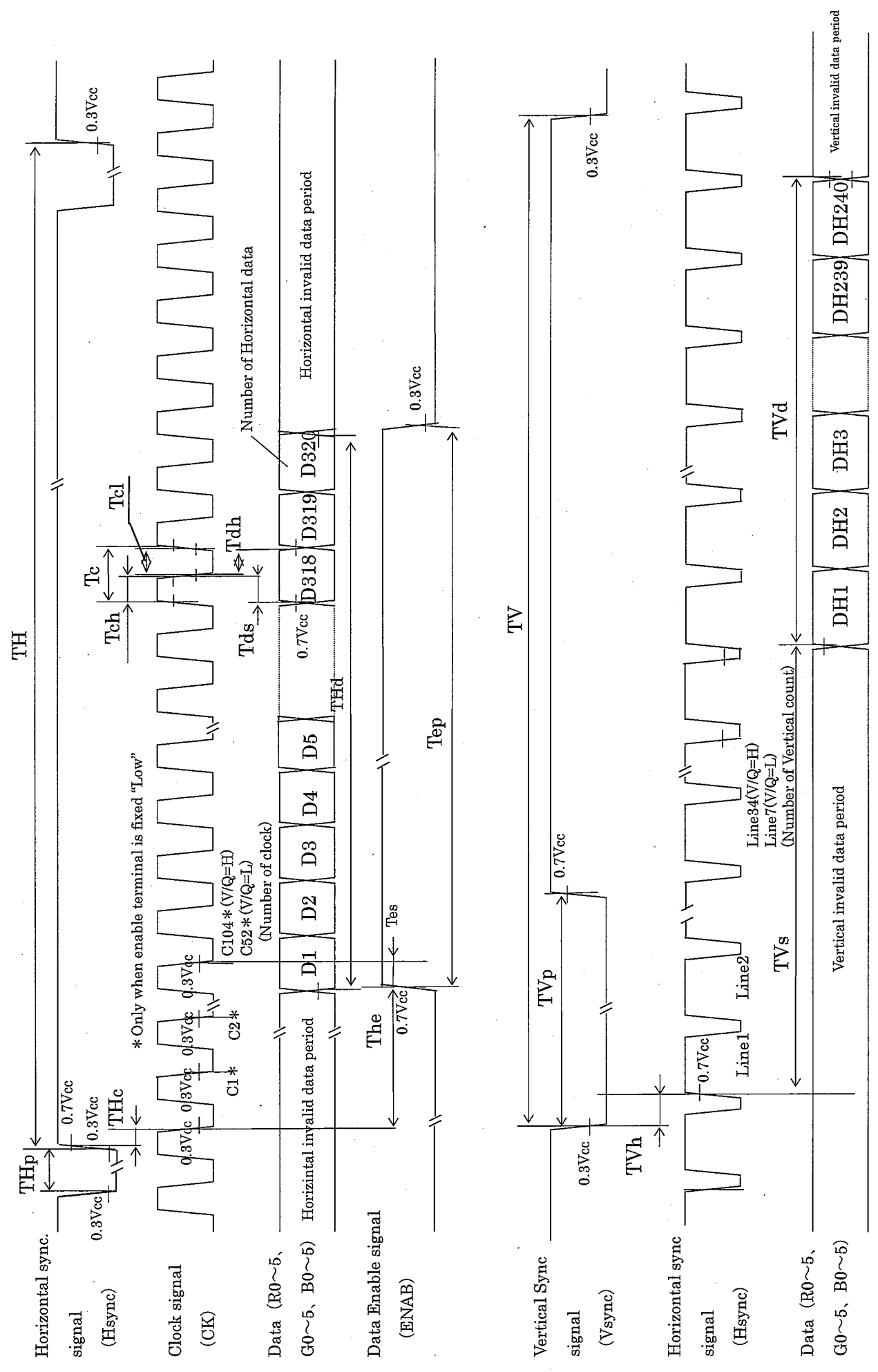


Fig 7. Input signal waveforms

(8) Input Signals, Basic Display Color and Gray Scale of Each Color

| 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 |
| | Bleu | 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

Table 9-1

Ta=25°C, VSH=+3.3V

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Remarks | |
|---------------------|------------------------|-----------------------|--------------|----------|----------|-------------------|------------|------------|
| Viewing angle range | $\theta 21, \theta 22$ | CR \geq 5 | (60) | (65) | — | ° (degree) | 【Note 9-1】 | |
| | $\theta 11$ | | (60) | (65) | — | ° (degree) | | |
| | $\theta 12$ | | (35) | (40) | — | ° (degree) | | |
| Contrast ratio | CRmax | Optimal viewing angle | (150) | — | — | | 【Note 9-2】 | |
| Response time | Rise | $\theta = 0^\circ$ | — | (30) | (60) | ms | 【Note 9-3】 | |
| | Fall | | — | (50) | (100) | ms | | |
| White chromaticity | x | IL=5mArms | (0.263) | (0.313) | (0.363) | | 【Note 9-4】 | |
| | y | | (0.279) | (0.329) | (0.379) | | | |
| Luminance | Y | | (TBD) | (500) | — | cd/m ² | | |
| lamp life time | +25°C | - | continuation | (40,000) | (50,000) | — | hour | 【Note 9-5】 |

Lamp test in the module is made with the following inverter:

HIU-288 [Output condenser : 22pF] TOSHIBA HARISON LIGHTING co. Ltd.

※ The optical specifications are measured 30 minute after turing lamp on and in adark room on equivalent condition, according to the method shown in Fig.9-1 below.

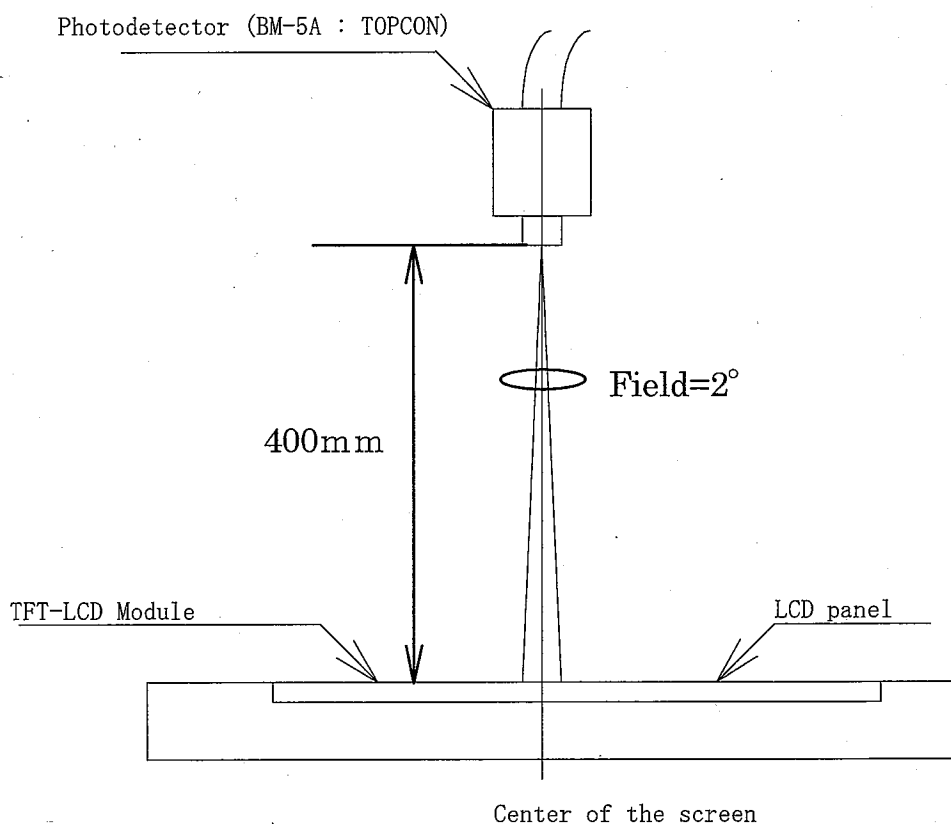
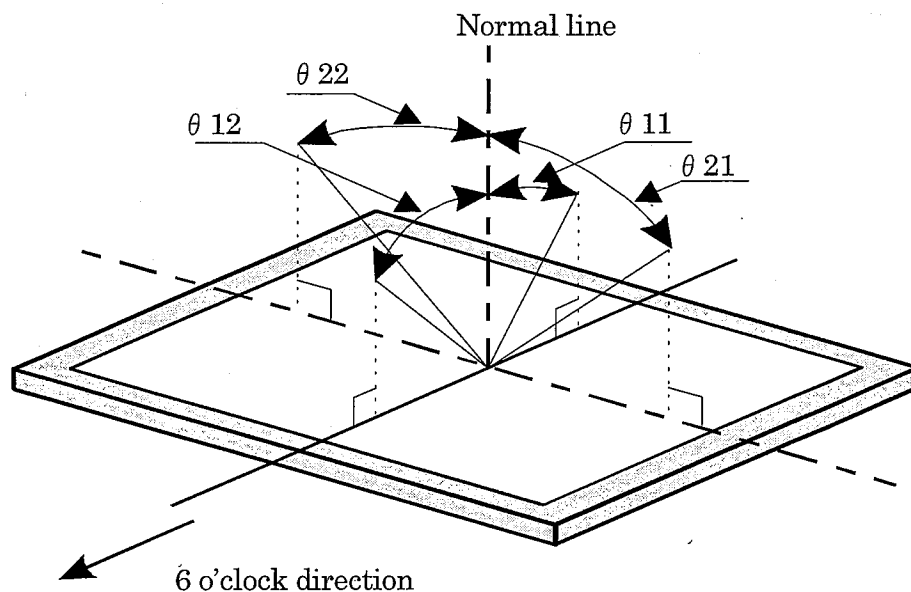


Fig.9-1 Optical characteristics measurement method

【Note 9-1】 Viewing angle range is defined as follows.

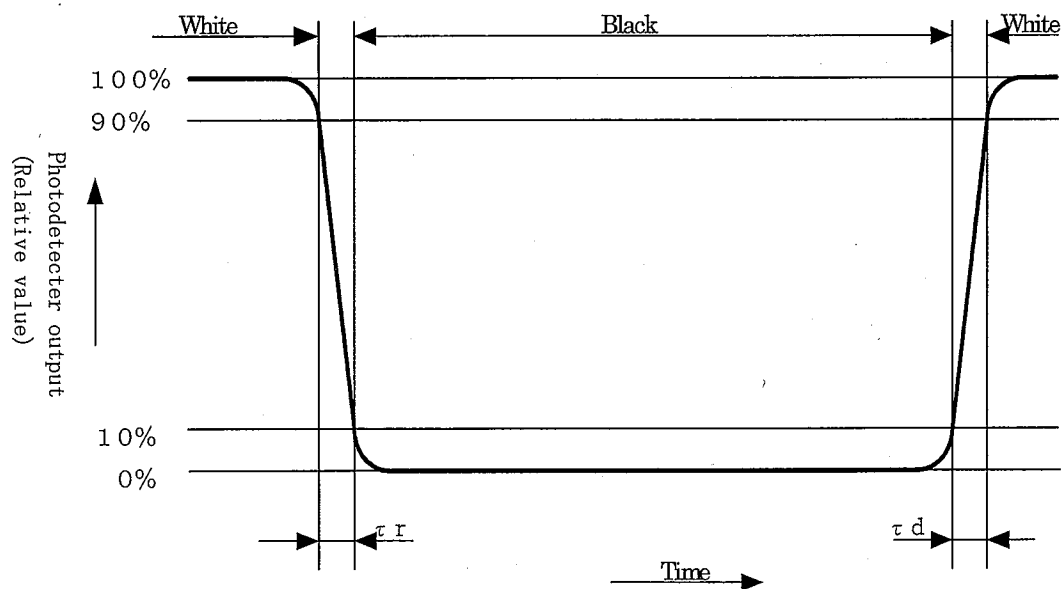


【Note 9-2】 Contrast ratio is defined as follows:

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

※ Measurement point : Center of the active area

【Note 9-3】 Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".



【Note 9-4】 This parameter should be measured at the center of the screen and 30 minutes after turn-on.
Inverter frequency: 49kHz
The characteristics are measured when the driver circuit is not powered.

【Note 9-5】 The data for lamp is for your reference, because lamp is consumable component.

- a) Lamp life time is defined by either 1 or 2 below.
(Continuous turning on at $T_a=25^\circ\text{C}$, $I_L=5\text{mA rms}$)
- ① When a brightness of lamp surface become 50% of the initial value under the standard condition.
 - ② When a kick-off voltage in $T_a=-10^\circ\text{C}$ exceeded maximum value(1470 Vrms)

at the output of inverter circuitry.

- b) 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.

10. Handling instructions

10-1. Mounting of modules

- ① The TFT-LCD module is designed to be mounted on equipment using the mounting tabs in the four corners of the module at the rear side. On mounting the module, as the M3 tapping screw (fastening torque is 0.25 through 0.30 N·m) is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.
The pushing module, (ex. touching switch etc.) causes disordered image. So taking care not to conduct directly for LCD modules.
- ② Please power off the module when you connect the input/output connector.
- ③ Connect the metallic shielding cases of the module and the ground pattern of the inverter circuit firmly. If that connection is not perfect, there may be a possibility that the following problems happen.
 - a) The noise from the backlight unit will increase.
 - b) The output from inverter circuit will be unstable.
 - c) In some cases, a part of module will heat up.

10-2. Precautions in mounting

- ① Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
- ② Method of removing dust from polarizer.
 - Blow off dust with N2 blower for which static electricity preventive measure has been taken.
 - Since the polarizer is easily damaged, wiping should be avoided. If the panel has stain or finger grease, we recommend to use adhesive tape to softly remove them from the panel. Inevitable, wipe off by cleaning cloth for a lens with carefully, breathing on it.
- ③ When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth. For stubborn dirties, wipe the part, breathing on it.
- ④ Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.
- ⑤ TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. handle with care.
- ⑥ Since CMOS LSIs are incorporated in this module, take care of electrostatic and earth human body while handling.

10-3. Caution of product design

The notes and cautions below should be followed when product is designed with this module.

- ① The LCD module should be protected against water salt-water by the waterproof cover.
- ② Take enough shielding countermeasure not to interfere to peripheral electric device.

10-4. Others

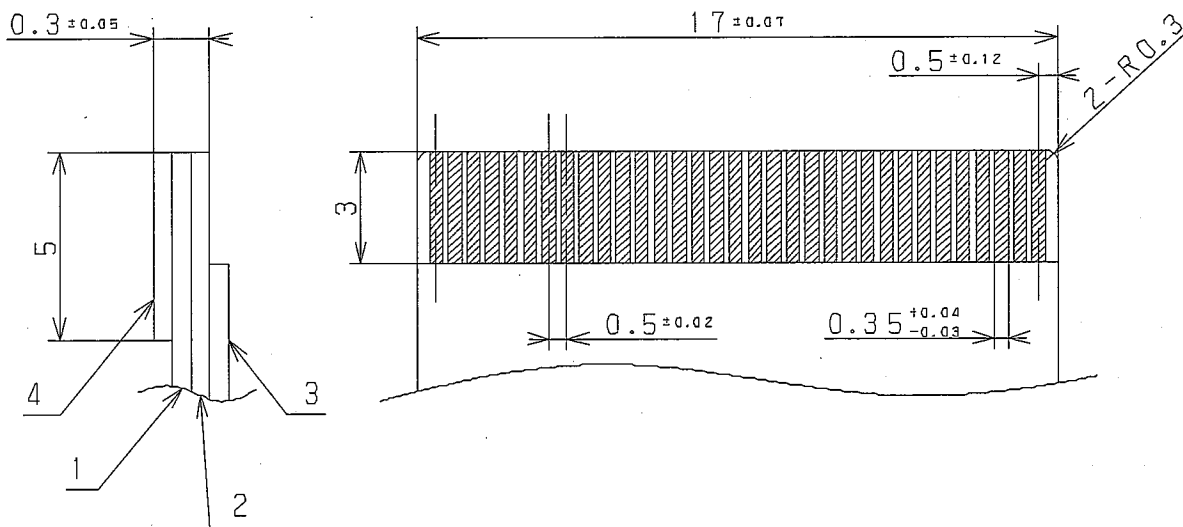
- ① Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours; liquid crystal is deteriorated by ultraviolet rays.
- ② If stored at the temperature lower than rated temperature, the liquid crystal may freeze and it may cause LCD panel damage. If storage temperature exceeds the specified rating, the molecular orientation of the liquid crystal may change to that of a liquid, and they may not revert to their original state. Store the module in normal room temperature.
- ③ The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump lead line around.
- ④ If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. If the liquid crystal drip into the eyes or mouth washes it out immediately.
- ⑤ The caution to other ordinal electronic component should be followed also.

11. Shipping requirements

- a) Number of layers of cartons in pile : 12 layers max.
- b) Maximum number of product contained: 20 units per 1 carton.
- c) Carton size : 442mm(W) × 390mm(H) × 170mm(D)
- d) Total mass (for 20 units) : 5500g
- e) Carton stock environment :
 - ① Temperature 0°C to 40°C
 - ② Humidity 60%RH or less
 - ③ Atmosphere Harmful gases such as acid and alkali which corrode electric components and wires must not be detected.
 - ④ Storage period Approximately 3 months
 - ⑤ Opening of package To prevent TFT-LCD module from being damaged by electrostatic, adjust the humidity to 50%RH or higher and provide an appropriate measure for electrostatic earthing before opening the package.

12. Others

- a) Adjusting volumes have been set optimally before shipment. Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described here may not be satisfied.
- b) Disassembled the module, it may cause malfunction.
- c) Be careful since image retention may occur when a fixed pattern is displayed for a long time.
- d) Input/Output connector for TFT-LCD panel driving part
 Used connector : FH12-33S-0.5SH (HIROSE ELECTRIC CO., LTD.)
 - 1) Fit FPC : Refer to the following figure
 - 2) Keeping power of terminal : 0.9N/pin or more
 [Every terminal is pulled out 25 ± 3mm/minute]
 - 3) Endurance of insert/pull out : Less than double of the initial resistance value
 [The electrical resistance value of the contact changed by the repeated insertion/pulling out by 20 times to and from the matching FPC]



| No. | Parameter | Material |
|-----|------------------|--|
| 1 | Base material | Polyimide or the equivalent [25um thickness] |
| 2 | Copper leaf | Copper leaf [35um thickness] gold leaf [2um or more thickness] |
| 3 | Coverlay | Polyimide or the equivalent |
| 4 | Reinforced sheet | Polyester/polyimide or the equivalent [188um thickness] |

Fit FPC for Input/Output connector : 0.5mm pitch

13. Reliability Test Conditions for TFT-LCD Module

Table 13-1

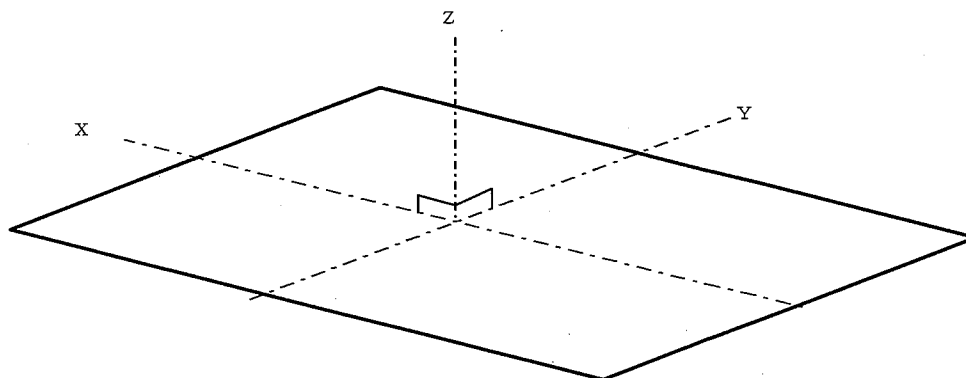
| No. | Test items | Test conditions |
|-----|---|---|
| 1 | High temperature storage test | Leaves the module at $T_a = +80^{\circ}\text{C}$ for 240h 【Note 1】 |
| 2 | Low temperature storage test | Leaves the module at $T_a = -30^{\circ}\text{C}$ for 240h 【Note 1】 |
| 3 | High temperature and high humidity operating test | Operates the module at $T_p = +40^{\circ}\text{C}$, 95%RH for 240h (No condensation) 【Note 1】 |
| 4 | High temperature operating test | Operates the module at $T_p = +70^{\circ}\text{C}$ for 240h 【Note 1】 |
| 5 | Low temperature operating test | Operates the module at $T_a = -10^{\circ}\text{C}$ for 240h (The lifetime of a CCFT is not included) 【Note 1】 |
| 6 | Strength against ESD | $\pm 200\text{V} \cdot 200\text{pF}(0\Omega)$ 1 time for each terminals |
| 7 | Shock test (non-operating) | $490\text{m/s}^2 \cdot 6\text{ms}$, $\pm X$; $\pm Y$; $\pm Z$ 3 times for each direction (JIS C0041, A-7 Condition C) |
| 8 | Vibration test (non-operating) | Frequency : $5 \sim 57\text{Hz}$, Stroke : 1.5mm Frequency : $58 \sim 500\text{Hz}$, Acceleration : 9.8m/s^2 Sweep cycle : 11 minutes X,Y,Z 1 hours for each directions (total 3 hours) 【Note 2】 (JIS D1601) |
| 9 | Thermal shock test | $T_a = -30^{\circ}\text{C} \sim +80^{\circ}\text{C}$, 200 cycles (0.5h) (0.5h) |

【Result evaluation criteria】

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

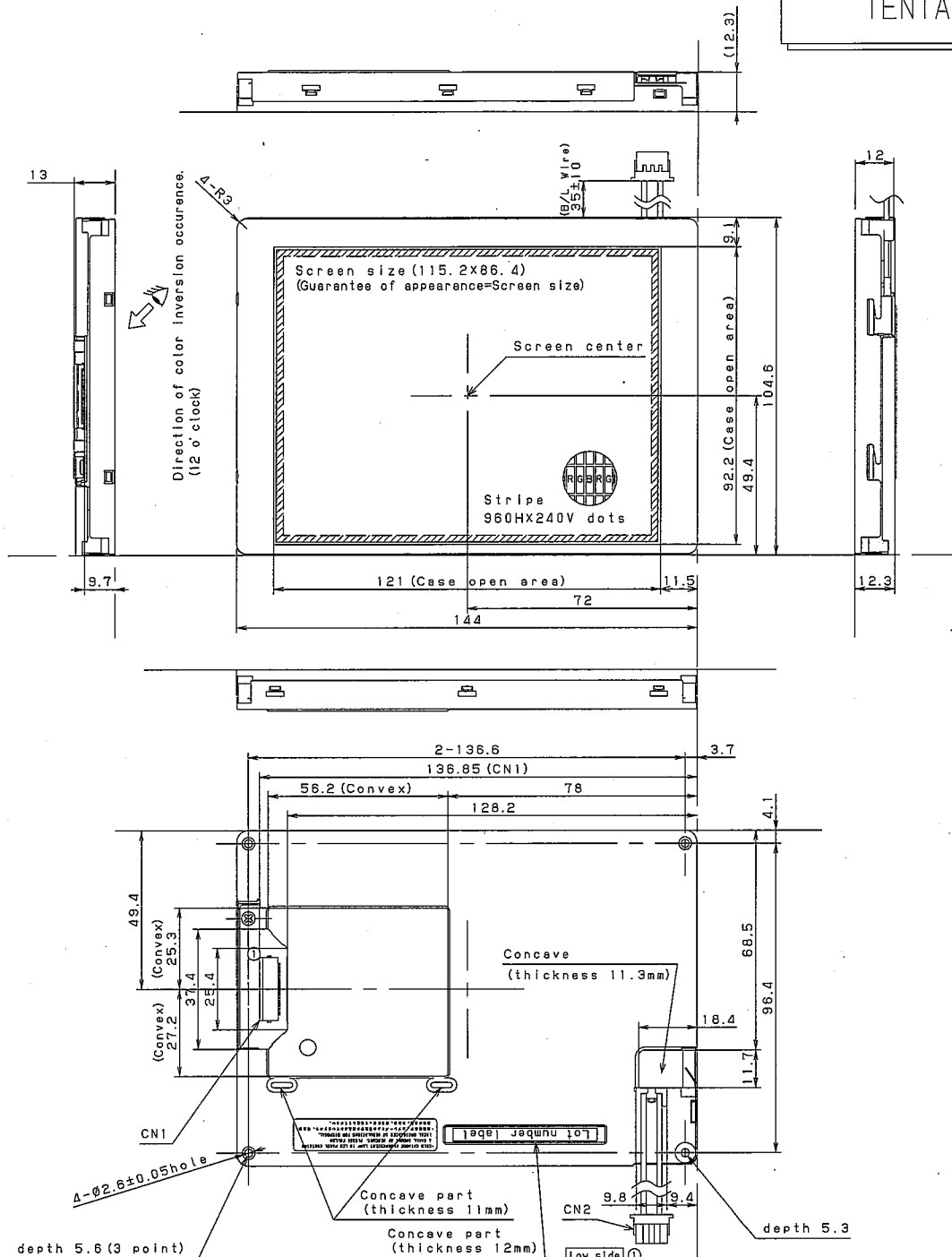
【Note 1】 T_a = Ambient temperature, T_p = Panel surface temperature

【Note 2】 X,Y,Z directions are shown as follows:



SHARP

TENTATIVE



① SIGNAL OF CONNECTOR'S TERMINAL

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|----|-------|-------|-----|----|----|----|----|----|----|-----|----|----|----|----|----|----|-----|----|----|----|----|----|----|-----|------|-----|-----|-----|-----|-----|-----|
| GND | CK | Hsync | Vsync | GND | R0 | R1 | R2 | R3 | R4 | R5 | GND | G0 | G1 | G2 | G3 | G4 | G5 | GND | B0 | B1 | B2 | B3 | B4 | B5 | GND | ENAB | Vcc | Vcc | R/L | U/L | V/Q | GND |
|-----|----|-------|-------|-----|----|----|----|----|----|----|-----|----|----|----|----|----|----|-----|----|----|----|----|----|----|-----|------|-----|-----|-----|-----|-----|-----|

- 1) Take care in set design to hide the scratches and bubbles appeared on the polarizer or other flame area.
- 2) CN1:I/O connector is FH12-33S-0.5SH (HIROSE electric)
CN2:CCFT connector is BHR-02 (8.0) VS-1N (JST)
- 3) The whole curvature is not included thickness direction.
- 4) Recommendation screw is 3mm tapping.
- 5) The leught of screw into the inside of module is made 4mto5mm.

Since this module is under development, all the specified value is tentative. The technical literature is subject to change without notice.

unit:mm
General tolerance is ± 0.5

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| | | | | | |
|------------|-------------------------|-------------------|------|---|-------|
| DATE | ' 04.12.20 | SCALE | 1/1 | | |
| MODEL | LIQ01571Q3DC112111 | No. | DATE | REVISION | Sign. |
| DRAWING NO | LCW1-014101871A size A2 | SHARP CORPORATION | | MOBILE LCD DESIGN CENTER I ENGINEERING DEPT. I | |

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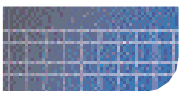
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