

# LCD Specification

LCD Group

## LQ022B8UD05 LCD Module

### Product Specification

December 2009

QCIF+ LCD Module featuring 125 nits brightness with 60:1 contrast. Full specification listing.

|                                                          |                                                                                                                              |                                                                                                                                         |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| PREPARED BY: DATE<br><i>N. Yamashita</i><br>Dec. 9. 2009 | <div style="text-align: center;"> <h1>SHARP®</h1> <p>MOBILE LIQUID CRYSTAL DISPLAY GROUP</p> <p>SHARP CORPORATION</p> </div> | SPEC No. LCP-05032F                                                                                                                     |
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|                                                          |                                                                                                                              | PAGE Pages 22<br>APPLICABLE DIVISION<br><br>ENGINEERING DEPARTMENT III<br>MOBILE LCD DIVISION II<br>MOBILE LIQUID CRYSTAL DISPLAY GROUP |
| <h2>SPECIFICATION</h2>                                   |                                                                                                                              |                                                                                                                                         |

DEVICE SPECIFICATION for

TFT LCD Module

(176 × RGB × 220 dots)

Model No.

**LQ022B8UD05**

☐ CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

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[illegible]

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## [For handling and system design]

- (1) Do not scratch the surface of the polarizer film as it is easily damaged.
- (2) If the cleaning of the surface of the LCD panel is necessary, wipe it swiftly with cotton or other soft cloth. Do not use organic solvent as it damages polarizer.
- (3) Water droplets on polarizer must be wiped off immediately as they may cause color changes, or other defects if remained for a long time.
- (4) Since this LCD panel is made of glass, dropping the module or banging it against hard objects may cause cracks or fragmentation.
- (5) Certain materials such as epoxy resin (amine's hardener) or silicone adhesive agent (de-alcohol or de-oxy) emits gas to which polarizer reacts (color change). Check carefully that gas from materials used in system housing or packaging do not harm polarizer.
- (6) Liquid crystal material will freeze below specified storage temperature range and it will not get back to normal quality even after temperature comes back within specified temperature range. Liquid crystal material will become isotropic above specified temperature range and may not get back to normal quality. Keep the LCD module always within specified temperature range.
- (7) Do not expose LCD module to the direct sunlight or to strong ultraviolet light for long time.
- (8) If the LCD driver IC (COG) is exposed to light, normal operation may be impeded. It is necessary to design so that the light is shut off when the LCD module is mounted.
- (9) Do not disassemble the LCD module as it may cause permanent damage.
- (10) As this LCD module contains components sensitive to electrostatic discharge, be sure to follow the instructions in below.
  - ① Operators  
Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.
  - ② Equipment and containers  
Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic

charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.

③ Floor

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

④ Humidity

Proper humidity of working room may reduce the risk of electrostatic charge up and discharge. Humidity should be kept over 50% all the time.

⑤ Transportation/storage

Storage materials must be anti-static to prevent causing electrostatic discharge.

⑥ Others

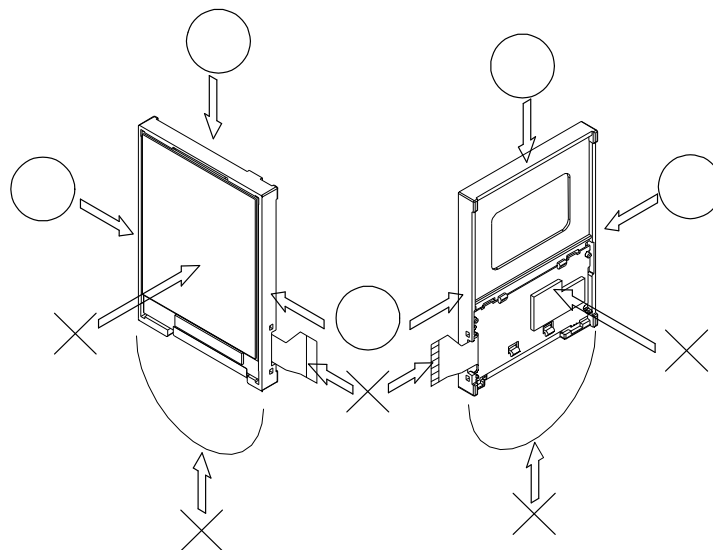
Protective film is attached on the surface of LCD panel to prevent scratches or other damages. When removing this protective film, remove it slowly under proper anti-ESD control such as ion blower.

(11) Hold LCD very carefully when placing LCD module into the system housing. Do not apply excessive stress or pressure to LCD module. Do not to use chloroprene rubber as it may affect on the reliability of the electrical interconnection.

(12) Do not hold or touch LCD panel to flex interconnection area as it may be damaged.

(13) As the binding material between LCD panel and flex connector mentioned in 12) contains an organic material, any type of organic solvents are not allowed to be used. Direct contact by fingers is also prohibited.

(14) When carrying the LCD module, place it on the tray to protect from mechanical damage. It is recommended to use the conductive trays to protect the CMOS components from electrostatic discharge. When holding the module, hold the Plastic Frame of LCD module so that the panel, COG and other electric parts are not damaged.



(15) Do not touch the COG's patterning area. Otherwise the circuit may be damaged.

(16) Do not touch LSI chips as it may cause a trouble in the inner lead connection.

(17) Place a protective cover on the LCD module to protect the glass panel from mechanical damages.

(18) LCD panel is susceptible to mechanical stress and even the slightest stress will cause a color change in background. So make sure the LCD panel is placed on flat plane without any continuous twisting, bending or pushing stress.

(19) Protective film is placed onto the surface of LCD panel when it is shipped from factory. Make sure to peel it off before assembling the LCD module into the system. Be very careful not to damage LCD module by electrostatic discharge when

peeling off this protective film. Ion blower and ground strap are recommended.

(20) Make sure the mechanical design of the system in which the LCD module will be assembled matches specified viewing angle of this LCD module.

(21) This LCD module does not contain nor use any ODS (1,1,1-Trichloroethane, CCL4) in all materials used, in all production processes.

### [For operating LCD module]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.

(2) Do not display still picture or the display over 2 hours as this will damage the liquid crystal.

(3) As opto-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

### [Precautions for Storage]

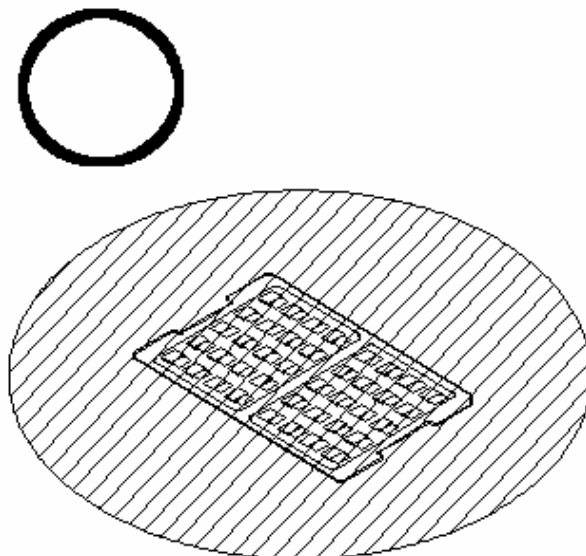
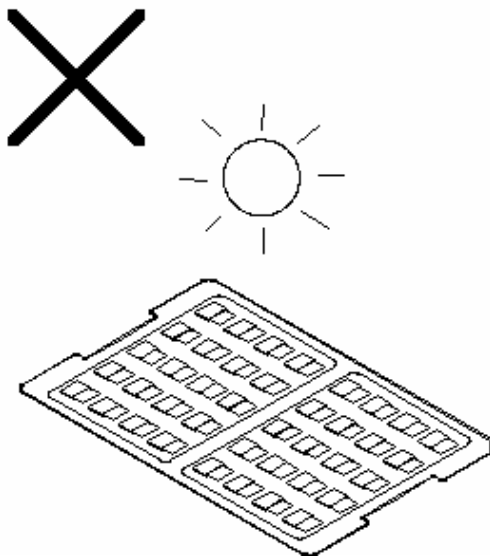
(1) Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.

(2) The liquid crystal material will solidify if stored below the rated storage temperature and will become an isotropic liquid if stored above the rated storage temperature, and may not retain its original properties. Only store the module at normal temperature and humidity (25±5°C, 60±10%RH) in order to avoid exposing the front polarizer to chronic humidity.

(3) Keeping Method

a. Don't keeping under the direct sunlight.

b. Keeping in the tray under the dark place.



(4) Do not operate or store the LCD module under outside of specified environmental conditions.

(5) Be sure to prevent light striking the chip surface

**[Other Notice]**

- (1) Do not operate or store the LCD module under outside of specified environmental conditions.
- (2) As electrical impedance of power supply lines (VEE-VSS, VDD-VSS) are low when LCD module is working, place the de-coupling capacitor near by LCD module as close as possible.
- (3) Reset signal must be sent after power on to initialize LSI. LSI does not function properly until initialize it by reset signal.
- (4) Generally, at power on, in order not to apply DC charge directly to LCD panel, supply logic voltage first and initialize LSI logic function including polarity alternation. Then supply voltage for LCD bias. At power off, in order not to apply DC charge directly to LCD panel, execute Power OFF sequence and Discharge command.
- (5) Don't touch to PWB surface, exposed IC chip, electric parts and other parts, to any electric, metallic materials.
- (6) No bromide specific fire-retardant material is used in this module.
- (7) Because including CMOS in this model, there is possibility that this module works wrongly by the noise from the antenna and so on. Please implement enough shields on user's product.

**[Precautions for Discarding Liquid Crystal Modules]**

- COG : After removing the LSI from the liquid crystal panel, dispose of it in a similar way to circuit boards from electronic devices.
- LCD panel : Dispose of as glass waste. This LCD module contains no harmful substances. The liquid crystal panel contains no dangerous or harmful substances. The liquid crystal panel only contains an extremely small amount of liquid crystal (approx.100mg) and therefore it will not leak even if the panel should break.
- PWB/FPC : Dispose of as similar way to circuit board from electric device.

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## 1. Application

This data sheet is to introduce the specification of LQ022B8UD05, active matrix 262,144 colors LCD module.  
The LCD module controlled by Driver ICs (LR38825 / LH169CH).

If any problem occurs concerning the items not stated in this specification, it must be solved sincerely by both parties after deliberation.

As to basic specification of driver IC refer to the IC specification and handbook.

## 2. Construction and Outline

Construction: LCD panel, Driver (COG), FPC with electric components,  
4 pieces White LED lump, prism sheet, diffuser, light guide and reflector, plastic frame to fix them mechanically.

Outline: See Fig.12 (page 22).

Connection: 35 pins; 0.3mm pitch ZIF FPC connector. Correspondable connector: FF02B35SS1 (JAE)

## 3. Mechanical Specification

Table 1

| Parameter             |                | Specifications                | Unit |
|-----------------------|----------------|-------------------------------|------|
| Outline dimensions *1 |                | 42.1 (W) × 56.6 (H) × 4.2 (D) | mm   |
| LCD<br>Panel          | Active area    | 34.848 (W) × 43.56 (H)        | mm   |
|                       | Display format | 176×RGB(W)×220(H)             | -    |
|                       | Dot pitch      | 0.066 (W) × 0.198 (H)         | mm   |
|                       | Base color *2  | Normally white                | -    |
| Mass                  |                | Approx 12.1                   | g    |

\*1 See Fig.12 (page 22)

\*2 Due to the characteristics of the LC material, the colors vary with environmental temperature.

## 4. Absolute Maximum Ratings

### (4-1) Electrical absolute maximum ratings

Table 2

Ta=25°C

| Parameter                | Symbol           | Min  | Max     | Unit | Remark |
|--------------------------|------------------|------|---------|------|--------|
| Supply voltage for LCD   | VEE-VSS          | -0.3 | 4.0     | V    | VEE    |
| Supply voltage for Logic | VDD-VSS          | -0.3 | 4.0     | V    | VDD    |
| Input Voltage            | V <sub>IN</sub>  | -0.3 | VDD+0.3 | V    | *1     |
| LED forward current      | I <sub>LED</sub> | 0    | 30      | mA   | *2     |

\*1 Input terminal of logic system. : Voltage value is based on VSS = 0V.

\*2 See (5-2) LED back light (page 9)

### (4-2) Environment Conditions

Table 3

| Item                | Top     |       | Tstg    |       | Remark          |
|---------------------|---------|-------|---------|-------|-----------------|
|                     | MIN.    | MAX.  | MIN.    | MAX.  |                 |
| Ambient temperature | -10 °C  | +60°C | -20 °C  | +70°C | Note 2)         |
| Humidity            | Note 1) |       | Note 1) |       | No condensation |

Note1) Ta ≤ 40 °C.....95 % RH Max

Note2) Ta > 40 °C.....Absolute humidity shall be less than Ta=40 °C /95 % RH.

As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable. Be sure not to exceed the rated voltage, otherwise a malfunction may occur.

## 5. Electrical Specifications

### (5-1) Electrical characteristics

Table 4

Ta=25°C, VEE=3.0V, VDD=3.0V, VSS=0V

| Parameter                       | Symbol          | Conditions                                                      | Min.   | Typ. | Max.   | Unit | Applicable Pin |
|---------------------------------|-----------------|-----------------------------------------------------------------|--------|------|--------|------|----------------|
| Supply voltage for LCD          | VEE-VSS         | Ta=-10~60 °C                                                    | 2.8    | 3.0  | 3.2    | V    | VEE            |
| Supply voltage for Logic        | VDD-VSS         | Ta=-10~60 °C                                                    | 1.7    | 3.0  | 3.6    | V    | VDD            |
| "H" level input voltage         | V <sub>IH</sub> | Ta=-10~60 °C                                                    | 0.7VDD | -    | -      | V    | (note1)        |
| "L" level input voltage         | V <sub>IL</sub> |                                                                 | -      | -    | 0.3VDD | V    |                |
| "H" level Input leakage current | I <sub>IH</sub> | Ta=-10~60 °C<br>V <sub>IN</sub> = VSS or VDD                    | -      | -    | 10     | μA   | (note2)        |
| "L" level Input leakage current | I <sub>IL</sub> |                                                                 | -10    | -    | -      | μA   |                |
| "H" level output voltage        | V <sub>OH</sub> | Ta=-10~60 °C<br>I <sub>OH</sub> =-100μA, I <sub>OL</sub> =100μA | 0.8VDD | -    | -      | V    | (note3)        |
| "H" level output voltage        | V <sub>OL</sub> |                                                                 | -      | -    | 0.2VDD | V    |                |
| Current consumption for LCD     | I <sub>EE</sub> | Ta=25 °C                                                        | -      | 5.5  | 8.0    | mA   | (note4)        |
| Current consumption for Logic   | I <sub>DD</sub> |                                                                 |        | 2.0  | 10.0   | μA   |                |

(note1) /WR, /CS, RS, /RD, /RES, D0~D15

(note2) /WR, /CS, RS, /RD, /RES, D0~D15

(note3) LCDINT

(note4) Following Conditions

Ta=25 °C, VDD=3.0V, VEE=3.0V, Frame frequency = 80Hz

Display Pattern: All Black. No Host CPU access.

\*All Black pattern



## (5-2) LED back light

(1) At LCD panel, the back light use 4pieces white LED.

Table 5

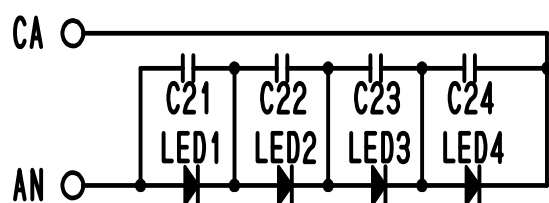
| Parameter       | Symbol    | Conditions | Min. | Typ. | Max. | Unit | Remark |
|-----------------|-----------|------------|------|------|------|------|--------|
| Forward current | $I_{LED}$ | Ta=25 °C   | -    | 20   | 30   | mA   | CA     |

LED maker : NICHIA Corporation

LED type : NSSW008CT

\*Please consider Allowable Forward Current on used temperature

(refer to Ambient Temperature vs. Allowable Forward Current curve)



C21~C24 : 0.1μF / 10V

Fig.1 LED circuit

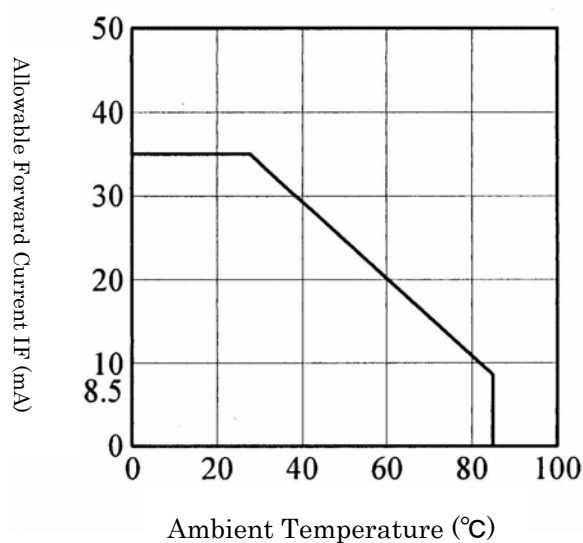


Fig.2 Ta vs. IF (NSSW008CT)

## <SPECIFICATIONS>

### (1) Absolute Maximum Ratings

Table 6

(Ta=25°C)

| Item                  | symbol      | MAX | unit |
|-----------------------|-------------|-----|------|
| Forward Current       | IF          | 35  | mA   |
| Pulse Forward Current | IFP         | 100 | mA   |
| Reverse Voltage       | $\theta y-$ | 5   | V    |
| Power Dissipation     | $\theta y+$ | 123 | mW   |

### (2) Initial Electrical / Optical Characteristics

Table 7

(Ta=25°C)

| Item            | Symbol | Condition | MIN | TYP   | MAX | unit |
|-----------------|--------|-----------|-----|-------|-----|------|
| Forward Voltage | VF     | IF=20mA   | -   | (3.2) | 3.5 | V    |
| Reverse Current | IR     | VR=5V     |     | -     | 50  | μ A  |

## (5-3) Interface signals

Table 8

| Pin No | Symbol | Description                                    | I/O | Remark                |
|--------|--------|------------------------------------------------|-----|-----------------------|
| 1      | VSS    | Ground level pin                               | -   | -                     |
| 2      | VSS    | Ground level pin                               | -   | -                     |
| 3      | VEE    | VEE level pin                                  | -   | For LCD driving       |
| 4      | D15    | Data Bus (MSB)                                 | I/O | (Note 1)              |
| 5      | D14    | Data Bus                                       | I/O | (Note 1)              |
| 6      | D13    | Data Bus                                       | I/O | (Note 1)              |
| 7      | D12    | Data Bus                                       | I/O | (Note 1)              |
| 8      | D11    | Data Bus                                       | I/O | (Note 1)              |
| 9      | D10    | Data Bus                                       | I/O | (Note 1)              |
| 10     | D9     | Data Bus                                       | I/O | (Note 1)              |
| 11     | D8     | Data Bus                                       | I/O | (Note 1)              |
| 12     | VSS    | Ground level pin                               | -   | -                     |
| 13     | D7     | Data Bus                                       | I/O |                       |
| 14     | D6     | Data Bus                                       | I/O |                       |
| 15     | D5     | Data Bus                                       | I/O |                       |
| 16     | D4     | Data Bus                                       | I/O |                       |
| 17     | D3     | Data Bus                                       | I/O |                       |
| 18     | D2     | Data Bus                                       | I/O |                       |
| 19     | D1     | Data Bus                                       | I/O |                       |
| 20     | D0     | Data Bus (LSB)                                 | I/O |                       |
| 21     | VSS    | Ground level pin                               | -   |                       |
| 22     | VSS    | Ground level pin                               | -   |                       |
| 23     | /WR    | Write control input pin                        | I   | "L" active            |
| 24     | RS     | Register select pin                            | I   |                       |
| 25     | /CS    | Chip select input pin                          | I   | "L" active            |
| 26     | /RES   | Reset signal input pin                         | I   | "L" active            |
| 27     | VDD    | VDD level pin                                  | -   | For Logic driving     |
| 28     | LCDINT | Interrupt request to the host bus              | O   | (Note 2)              |
| 29     | /RD    | Read control input pin                         | I   | "L" active            |
| 30     | IFM0   | Selection signal pin for host interface mode   | I   | L RS "H" : commands   |
|        |        |                                                |     | H RS "L" : commands   |
| 31     | BUS0   | Selection signal pin for the width of data bus | I   | L 8bit bus interface  |
|        |        |                                                |     | H 16bit bus interface |
| 32     | AN     | LED back light for (Anode)                     | -   | -                     |
| 33     | AN     | LED back light for (Anode)                     | -   | -                     |
| 34     | CA     | LED back light for (Cathode)                   | -   | -                     |
| 35     | CA     | LED back light for (Cathode)                   | -   | -                     |

Used connection : 0.3mm pitch ZIF FPC connector.

Correspondable connector : FF02B35SS1 (JAE)

(Note 1) For unused Data Bus, connect to VSS.

(Note 2) If don't use "LCDINT" pin, leave it open.

## (5-4) Host Interface Timing

### (1) Write

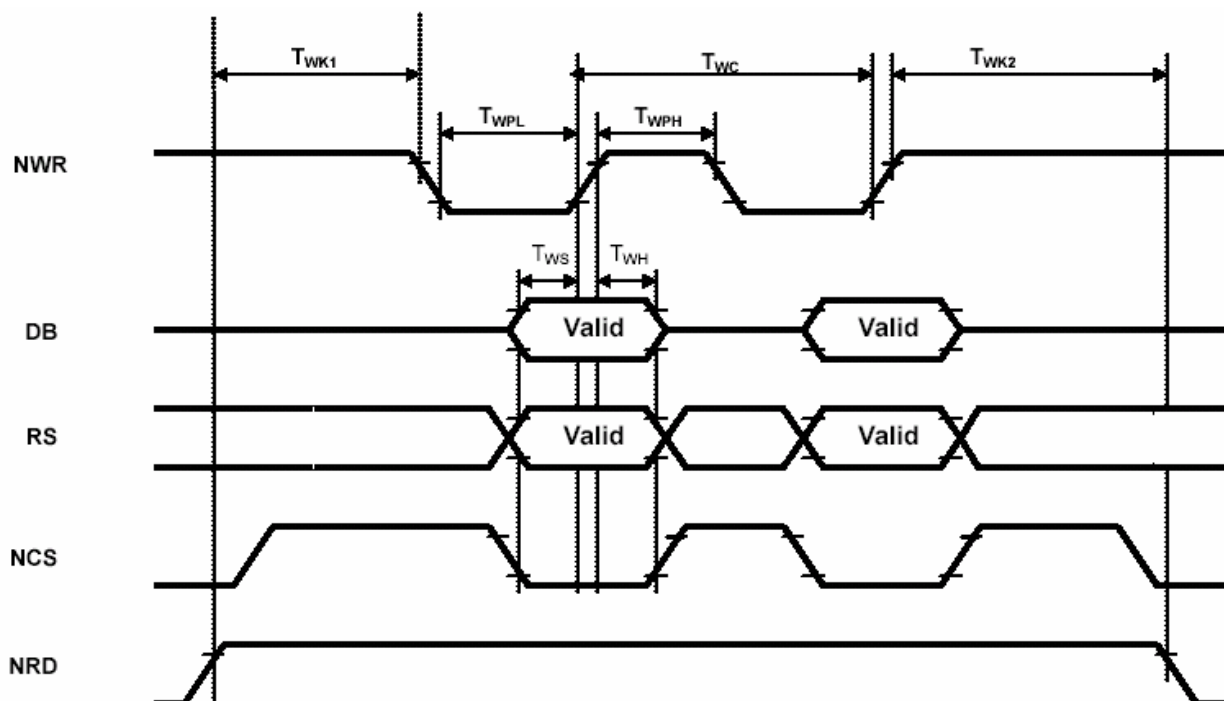


Fig.3 Host interface timing (Write)

Table 9

| Symbol    | Description                                      | Min.   | Max. | Note |
|-----------|--------------------------------------------------|--------|------|------|
| $T_{WPL}$ | Low period of NWR                                | 60 ns  | -    |      |
| $T_{WPH}$ | High period of NWR                               | 80 ns  | -    |      |
| $T_{WC}$  | Prohibit time re-writing                         | 140 ns | -    |      |
| $T_{WS}$  | Set up time of DB, RS and NCS to the NWR rising. | 50 ns  | -    |      |
| $T_{WH}$  | Hold time of DB, RS and NCS to the NWR rising.   | 0 ns   | -    |      |
| $T_{WK1}$ | Required time from the read cycle to write cycle | 300 ns | -    |      |
| $T_{WK2}$ | Required time from the write cycle to read cycle | 300 ns | -    |      |

Conditions:  $V_{DDIOH} = 1.65 \text{ V to } 3.3 \text{ V}$ ,  $V_{DDCORE} = 1.8 \pm 0.15 \text{ V}$ ,  $T_{opr} = -30^{\circ}\text{C to } +70^{\circ}\text{C}$ ,  $C_L = 10 \text{ pF}$

Reference input voltage:  $V_{IH} = 0.9 V_{DDIOH}$ ,  $V_{IL} = 0.1 V_{DDIOH}$

Reference output voltage:  $V_{OH} = 0.9 V_{DDIOH}$ ,  $V_{OL} = 0.1 V_{DDIOH}$

## (2) Read

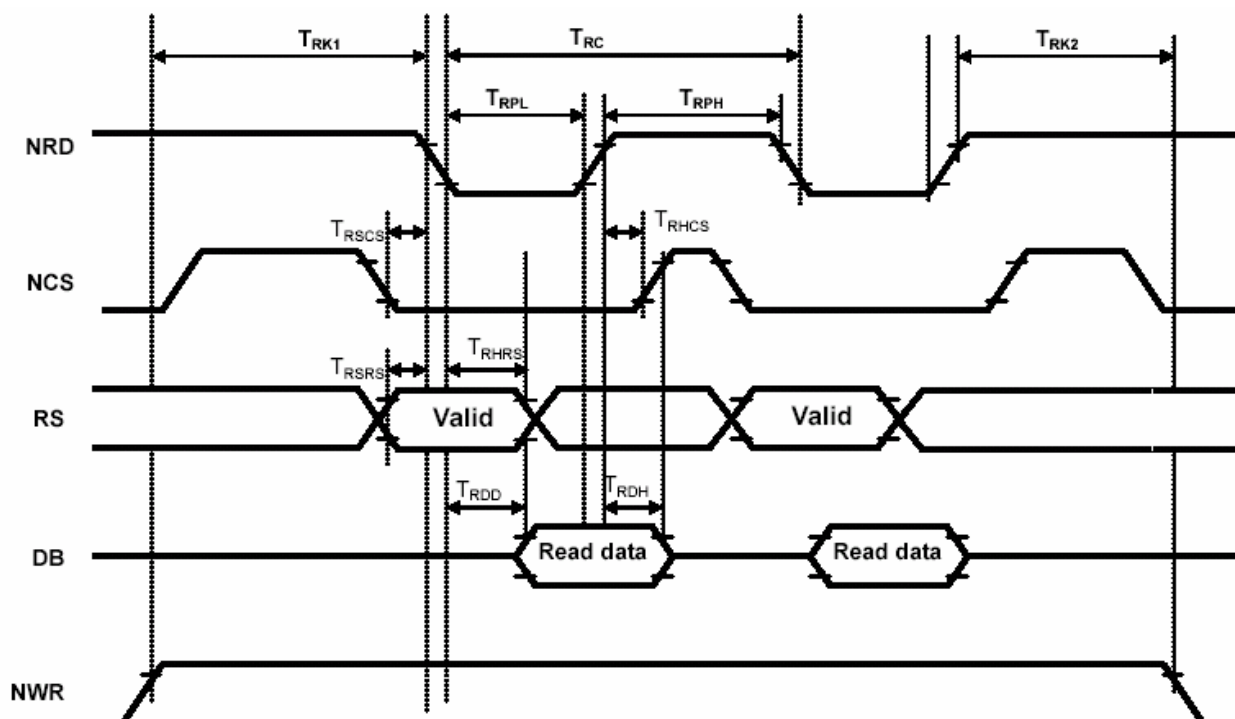


Fig.4 Host interface timing (Read)

Table 10

| Symbol     | Description                                        | Min.  | Max. |
|------------|----------------------------------------------------|-------|------|
| $T_{RPL}$  | Low period of NRD                                  | 100ns | -    |
| $T_{RPH}$  | High period of NRD                                 | 100ns | -    |
| $T_{RC}$   | Prohibition time for re-reading                    | 200ns | -    |
| $T_{RSRS}$ | Set up time of RS to NRD falling                   | 50ns  | -    |
| $T_{RSCS}$ | Set up time of NCS to NRD falling                  | 50ns  | -    |
| $T_{RHRS}$ | Hold time of RS from NRD falling                   | 50ns  | -    |
| $T_{RHCS}$ | Hold time of NCS from NRD rising                   | 50ns  | -    |
| $T_{RDD}$  | Time from NRD falling to confirmation of DB output | -     | 80ns |
| $T_{RDH}$  | Time from NRD rising to confirmation of DB output  | 5ns   | -    |

Conditions:  $V_{DDIOH} = 1.65\text{ V to }3.3\text{ V}$ ,  $V_{DDCORE} = 1.8 \pm 0.15\text{ V}$ ,  $T_{opr} = -30^{\circ}\text{C to }+70^{\circ}\text{C}$ ,  $C_L = 10\text{ pF}$

Reference input voltage:  $V_{IH} = 0.9 V_{DDIOH}$ ,  $V_{IL} = 0.1 V_{DDIOH}$

Reference output voltage:  $V_{OH} = 0.9 V_{DDIOH}$ ,  $V_{OL} = 0.1 V_{DDIOH}$

(5-5) Schematic of LCD module system

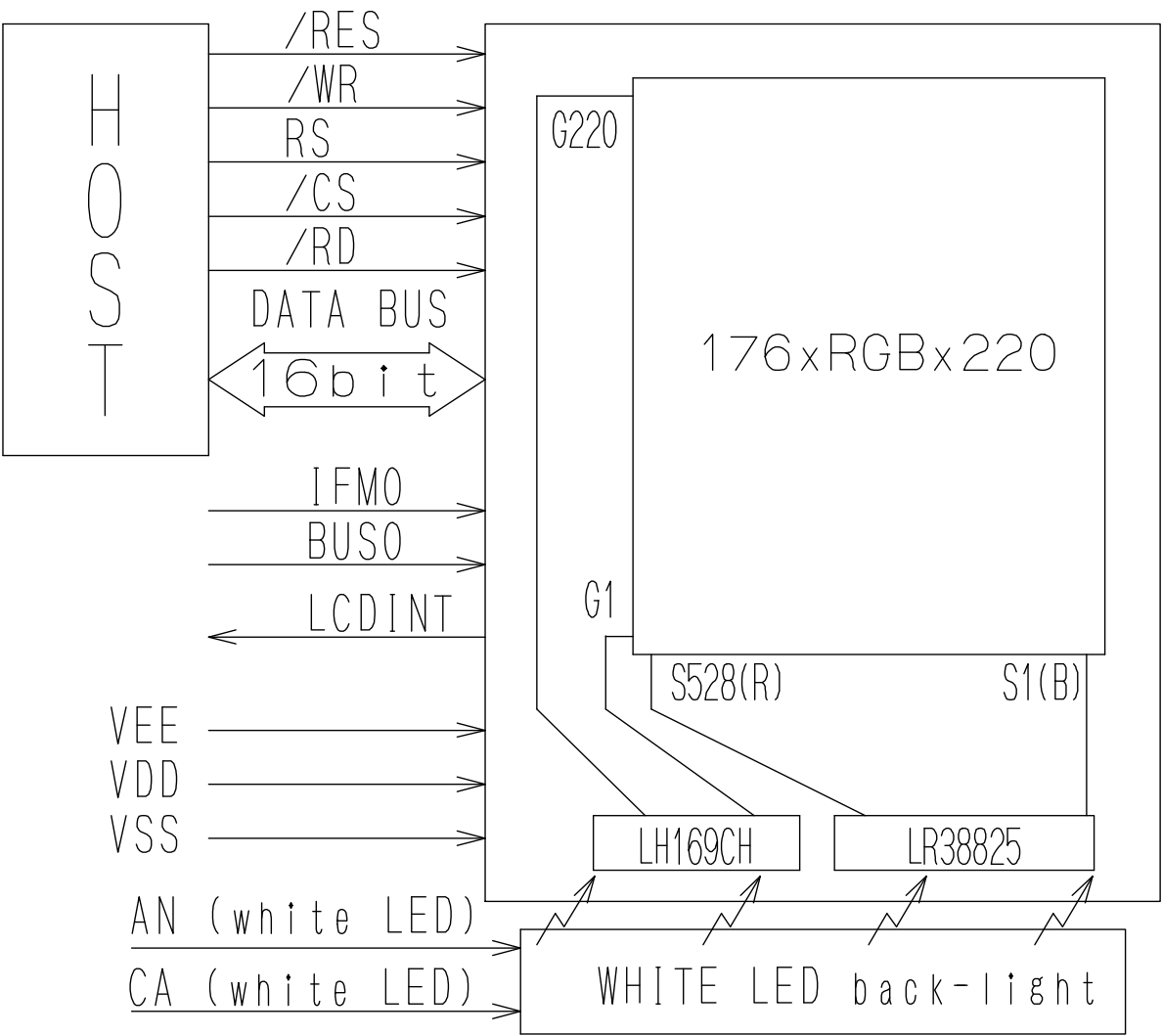


Fig.5 Schematic of LCD module system



## (5-6) Power ON/OFF sequence

### (1) Power ON

Table 11

| Register | Command | Remarks                                                           |
|----------|---------|-------------------------------------------------------------------|
| FD       | FD      | Software reset                                                    |
| FD       | FD      |                                                                   |
|          |         | WAIT (Min 50ms)                                                   |
| E0       | 01      | Gate reset                                                        |
|          |         | WAIT (Min 5 $\mu$ s)                                              |
| E0       | 00      | Gate reset release                                                |
| FE       | FE      | Host reset                                                        |
| FE       | FE      |                                                                   |
| EE       | 00      | EEPROM I/F ready [ Note ]                                         |
|          |         | WAIT (Min 10ms)                                                   |
| EF       | 00      | CPU bank active                                                   |
| 10       | 08      | Host Interface setting register (1)                               |
| 12       | AF      | VRAM access area setting register (X direction/start and pointer) |
| 13       | DB      | VRAM access area setting register (Y direction/start and pointer) |
| 15       | 00      | VRAM access area setting register (X direction/end)               |
| 16       | 00      | VRAM access area setting register (Y direction/end)               |
| 18       | 03      | Address auto increment setting register                           |
| 88       | 00      | Display displaying color setting register                         |
| 7E       | 04      | Display displaying setting register                               |
|          |         | WAIT (Min 20ms)                                                   |
| 7E       | 05      | Display displaying setting register                               |
| 7F       | 01      | V sync parameter transfer flag                                    |
|          |         | 【Write VRAM】                                                      |
| 80       | 01      | Display displaying control register (DIPS ON)                     |

[ Note ]

A setup peculiar value to a panel is written in EEPROM.

【Cautions】 Please do not rewrite

(2) Power OFF

Table 12

| Register | Command | Remarks              |
|----------|---------|----------------------|
| EF       | 00      | CPU bank active      |
| 1B       | 04      | Host reset enable    |
| FE       | FE      | Host reset           |
| FE       | FE      |                      |
| 7E       | 04      | Display setting      |
|          |         | WAIT (MIN 100ms)     |
| E3       | 04      | Dc setting           |
| E4       | 04      | Dc setting           |
| E2       | 01      | Dc off setting       |
| 80       | 00      | Display Off          |
|          |         | WAIT (MIN 100ms)     |
| E0       | 01      | Gate reset           |
| 7F       | 01      | TG parameter refresh |
|          |         | WAIT (MIN 5 $\mu$ s) |
| E0       | 00      | Gate reset release   |
| 7F       | 01      | TG parameter refresh |
|          |         | WAIT (MIN 5 $\mu$ s) |
| 01       | 01      | Oscillator stop      |
|          |         | 【Power off】          |

6. Optical Characteristics

Table 13 Ta =25°C

| Mode         | parameter          |       | symbol        | conditio<br>n      | MIN  | TYP  | MAX | unit              | Remark   |
|--------------|--------------------|-------|---------------|--------------------|------|------|-----|-------------------|----------|
| Transmissive | Brightness         |       | B             | $\theta=0^{\circ}$ | 88   | 125  | -   | cd/m <sup>2</sup> | Note 1,2 |
|              | Contrast           |       | Co            | $\theta=0^{\circ}$ | 40:1 | 60:1 | -   |                   | Note 1,3 |
|              | Viewing Angle      |       | $\theta_{y-}$ | $Co > 5$           | 20   | 30   | -   | deg               | Note 1   |
|              |                    |       | $\theta_{y+}$ |                    | 20   | 30   | -   |                   |          |
|              |                    |       | $\theta_{x-}$ |                    | 20   | 30   | -   |                   |          |
|              |                    |       | $\theta_{x+}$ |                    | 20   | 30   | -   |                   |          |
|              | Response Time      | Rise  | $\tau_{r1}$   | $\theta=0^{\circ}$ | -    | 18   | 35  | ms                | Note 1,4 |
|              |                    | Decay | $\tau_{d1}$   |                    | -    | 45   | 75  | ms                |          |
| Reflective   | White chromaticity |       | x             | $\theta=0^{\circ}$ | -    | 0.31 | -   |                   | Note 1,3 |
|              |                    |       | y             |                    | -    | 0.35 | -   |                   |          |
|              | Reflectance        |       | Rf            | $\theta=0^{\circ}$ | -    | 11   | -   | %                 | Note 5   |
|              | White chromaticity |       | x             | $\theta=0^{\circ}$ | -    | 0.30 | -   |                   | Note 5   |
|              |                    |       | y             |                    | -    | 0.34 | -   |                   |          |

Note 1) Definition of range of visual angle

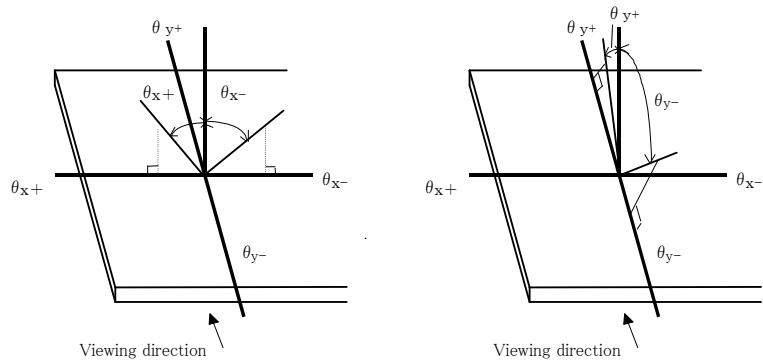


Fig.6 Definition of viewing angle

Note 2) Brightness is measured as shown in Fig.7, and is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

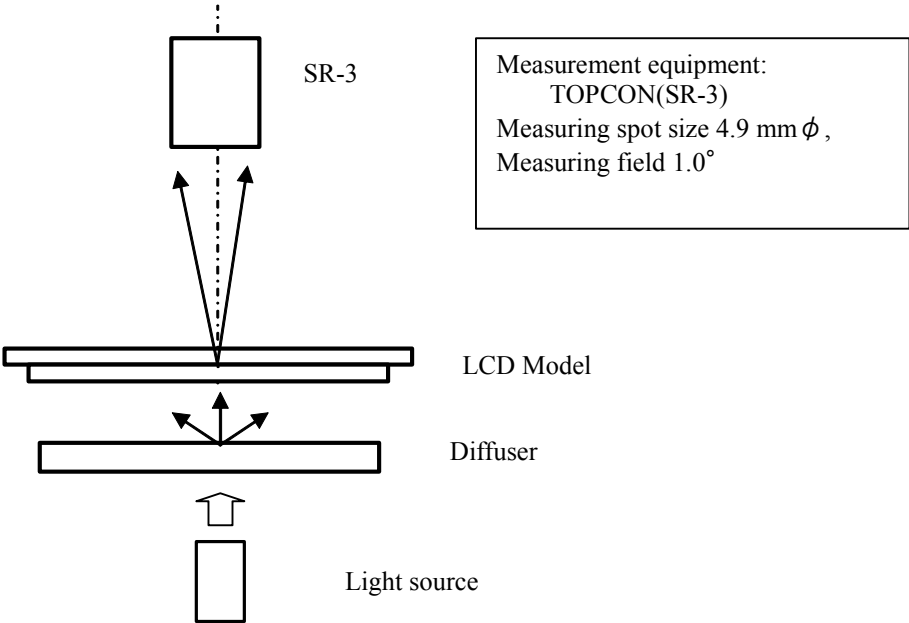


Fig.7 Optical characteristics Test Method (Brightness)

Note 3) Contrast ratio is defined as follows:

$$C_o = \frac{\text{Luminance(brightness) all pixels "White"}}{\text{Luminance(brightness) all pixels "dark"}}$$

Note 4) Response time is defined as follows:

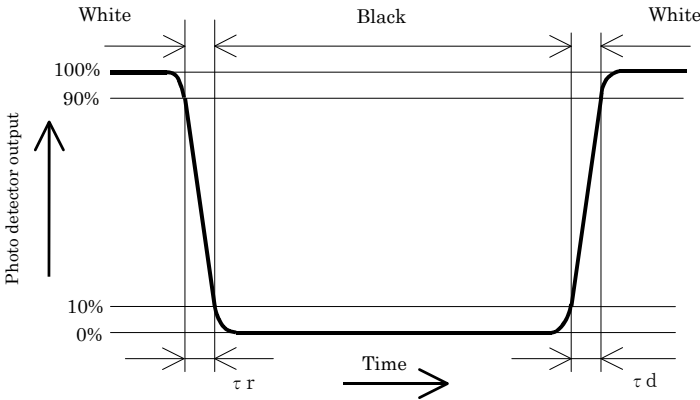


Fig.8 Response time (TFT)

Note 5) Reflectance is defined as follows:

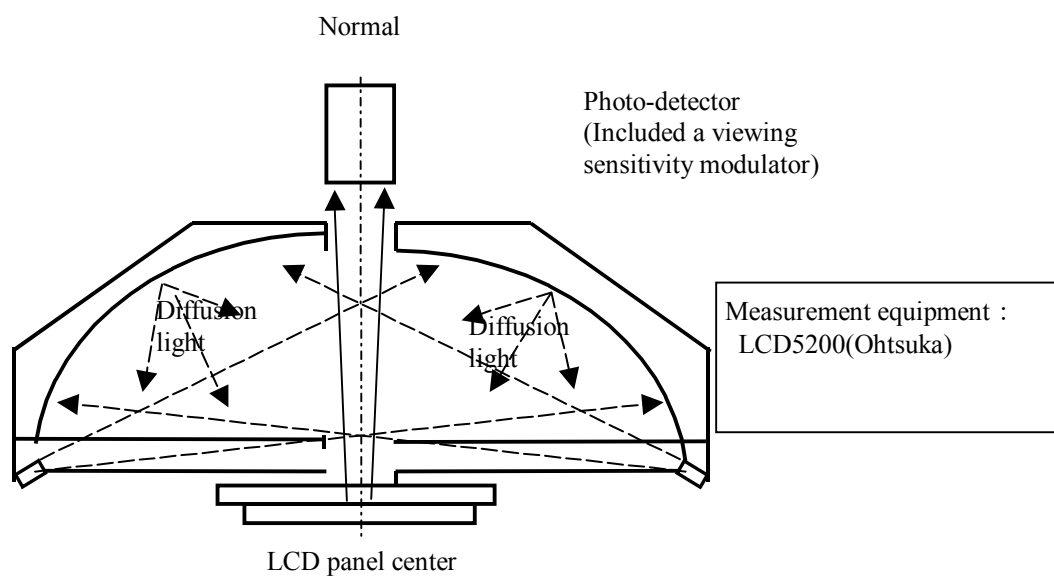
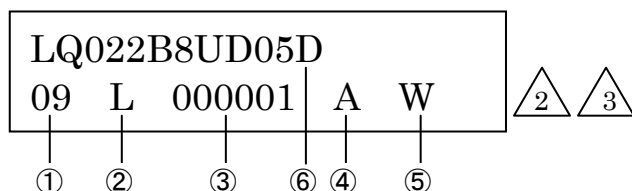


Fig.9 Optical Characteristics Test Method

## 7. Lot Number identification

Lot numbering and location are specified as follows.



①product year (lower 2 digits)

09:2009, 10:2010, .....

②product month

A: JANUARY, B: FEBRUARY, C: MARCH, ....., L: DECEMBER

③Serial number

000001 ~ 999999

④Record of Revision △2

A:1<sup>st</sup> revision, B:2<sup>nd</sup> revision, C:3<sup>rd</sup> revision, .....

⑤Product maker

W: SHARP

⑥Composition parts management code △5

A, B, C, D, ...

## 8. Packing specifications

### (8-1) Details of packing

1) Packing materials :Table.15

2) Packing style :Fig.11

### (8-2) Reliability

#### 1) Vibration test

Table.14

| Item      | Test                                           |            |            |       |
|-----------|------------------------------------------------|------------|------------|-------|
| Frequency | 5 Hz to 50 Hz (3 minutes cycle)                |            |            |       |
| Direction | Up-Down, Left-Right, Front-Back (3 directions) |            |            |       |
| Period    | Up-Dow                                         | Left-Right | Front-Back | Total |
|           | 60min                                          | 15min      | 15min      | 90min |

The frequency should start at 5 Hz and vary continuously.

Total amplitude 20mm 0.2mm 20mm 0.2mm

Frequency 5Hz 50Hz 5Hz 50Hz (For 9.8m/s<sup>2</sup>)

○ ○ ○  
| ← 3 minutes → |

#### 2) Drop test

Drop height: 750mm

Number of drop: 10timers (Ddrop sequence: 1 corner, 3 edges, 6 faces)

(8-3)Packing quantities

250 modules (max) per master carton

(8-4)Packing weight

About 7.7kg

(8-5)Paking outline dimensions

382mm × 578mm × 255mm

(Packing materials)

Table.15

|   | Parts name       | Materials                                                         |
|---|------------------|-------------------------------------------------------------------|
| 1 | Master carton    | Corrugate card board                                              |
| 2 | Under pad        | Corrugate card board                                              |
| 3 | Inside sleeve    | Corrugate card board                                              |
| 4 | Outside sleeve   | Corrugate card board                                              |
| 5 | Tray for packing | Polystyrene with anti-static treatment +anti-static polystyrene   |
| 6 | OPP tape         | Polypropylene                                                     |
| 7 | Protective bag   | Polyethylene with anti-static treatment +anti-static polyethylene |

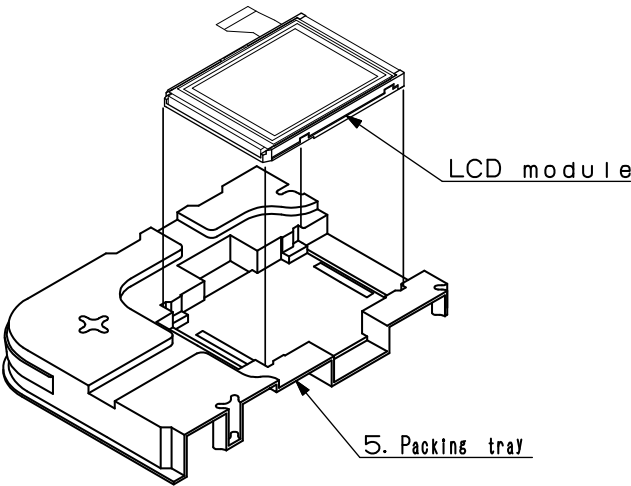


Fig.10

5

|            |  |                            |
|------------|--|----------------------------|
| TYPE       |  | 社内品番: (4S) LQ022B8UD05 D   |
| QUANTITY   |  | LotNO. : (IT) 2009, xx, xx |
| LOT (DATE) |  | Quantity: (Q) 250 PCS      |
|            |  | ユーザー品番:                    |
|            |  | シャープ製造用ラベルです。( ) ( )       |

【Quantities】  
1 tray : 25 modules (MAX)  
1 sleeve:125 modules (MAX)  
1 carton:250 modules (MAX)

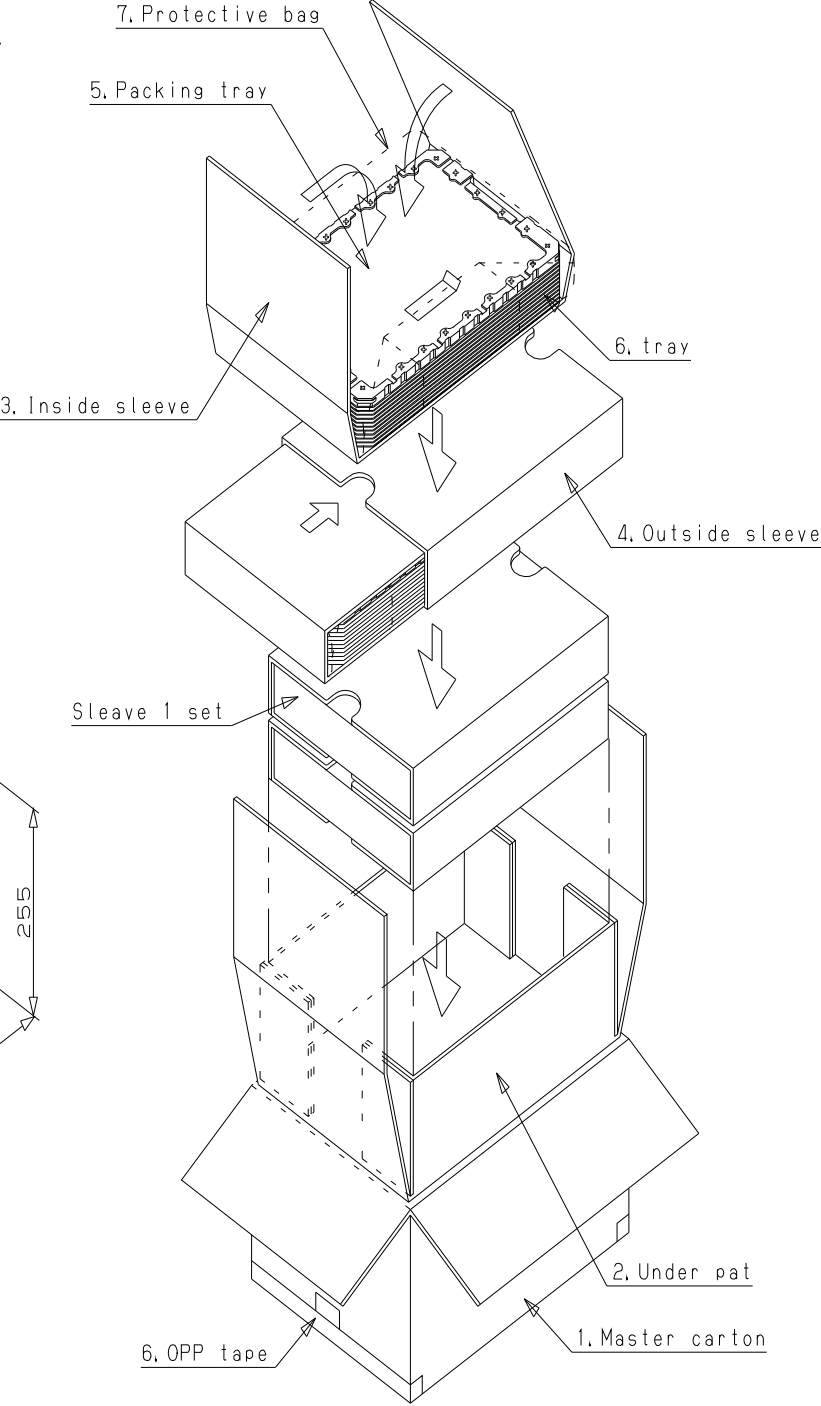
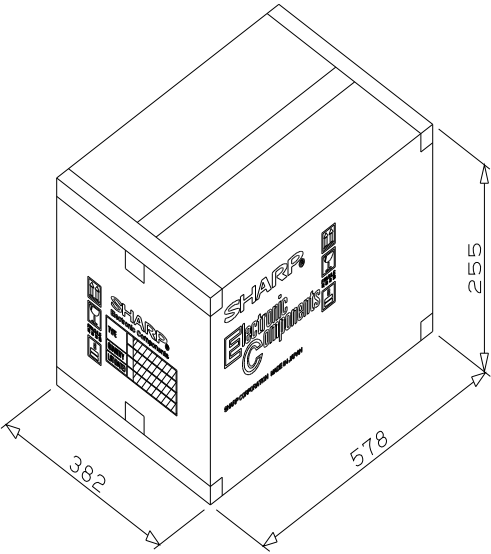


Fig.11



## 9. LCD module outline

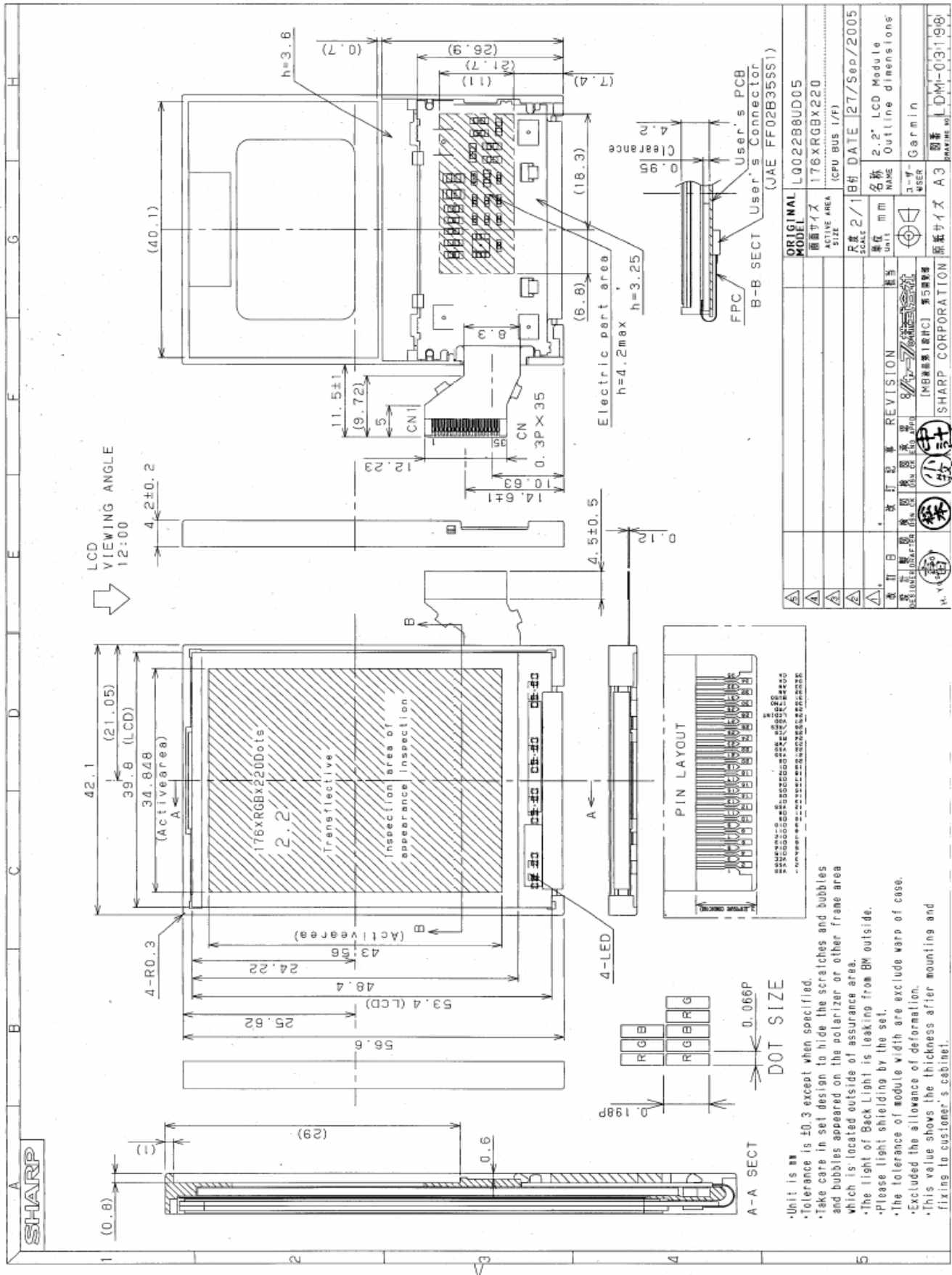


Fig. 12

# LCD Specification

## LCD Group



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Fax: (86) 755-88313515

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