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LQ035Q7DH01

TFT-LCD Module

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S H A R P

MOBILE LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

S P E C I F I C A T I O N

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Design Center
MOBILE LCD Enterprise
Development Center

DEVICE SPECIFICATION FOR

TFT-LCD module

MODEL No. LQ035Q7DH01

CUSTOMER'S APPROVAL

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(1) Application

This specification applies to LQ035Q7DH01

(2) Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor), named AD-TFT(Advanced TFT). It is practicable in both transmissive-type and reflection-type modes. It is composed of a color TFT-LCD panel, driver ICs, an FPC, a back light, a touch panel and a back sealed casing. It isn't composed control circuit. Graphics and texts can be displayed on a 240× 320 dots panel with 262,144 colors by supplying.

Optimum view angle is 6 o'clock. An inverted display mode is selective in the vertical or the horizontal direction.

(3) Mechanical specifications

Table 1

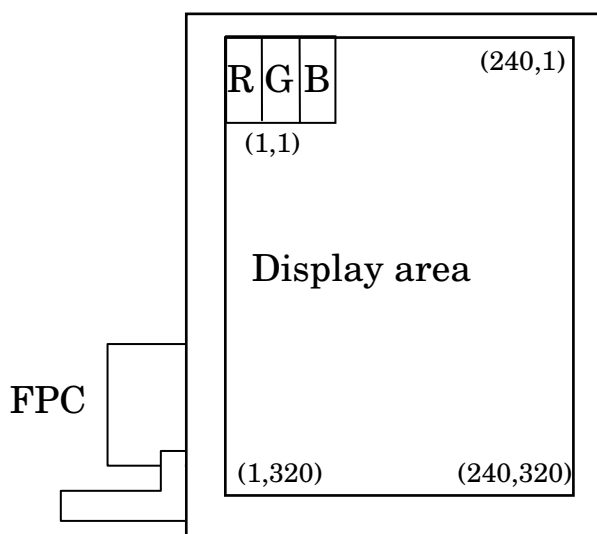
| Parameter | Specifications | Units | Remarks |
|------------------------|--|--------|-----------|
| Screen size (Diagonal) | 8.9 [3.52"] Diagonal | cm | |
| Display active area | 53.64 (H) × 71.52 (V) | mm | |
| Pixel format | 240(H)× 320(V) (1 pixel = R+G+B dots) | pixels | |
| Pixel pitch | 0.2235 (H) × 0.2235 (V) | mm | |
| Pixel configuration | R,G,B vertical stripe | | |
| Unit outline dimension | 65.0(W)× 86.2(H)× 4.0 (D) | mm | 【Note3-1】 |
| Mass | 45 | g | TYP. |
| Surface hardness | 3H | | |

【Note 3-1】

Excluding protrusion. Including FPC cover portion

For detailed measurements and tolerances, please refer to Fig. 1.

(4)Pixel configuration



(5)Input/Output terminal

5-1)TFT-LCD panel driving section

Table2

Recommendation CN : FH12A-50S-0.5SH(HIROSE)

| Pin No. | Symbol | I/O | Description | Remarks |
|---------|--------|-----|---|-----------|
| 1 | VL1 | I | Power supply for LED (High voltage) | |
| 2 | NC | - | | |
| 3 | VL2 | I | Power supply for LED (Low voltage) | |
| 4 | VEE | - | Power supply of gate driver(low level) | |
| 5 | VSHD | - | Power supply of digital | |
| 6 | DGND | - | Ground(digital) | |
| 7 | CLS | I | Clock signal of gate driver | |
| 8 | DGND | - | Ground(digital) | |
| 9 | SPS | I | Start signal of gate driver | |
| 10 | U/L | I | Selection for vertical scanning direction | 【Note5-1】 |
| 11 | MOD | I | Control signal of gate driver | 【Note5-2】 |
| 12 | VDD | - | Power supply of gate driver(high level) | |
| 13 | VCOM | I | Common electrode driving signal | |
| 14 | DGND | - | Ground(digital) | |
| 15 | SPR | I/O | Sampling start signal | |
| 16 | DGND | - | Ground(digital) | |
| 17 | VSHA | - | Power supply(analog) | |
| 18 | LBR | I | Selection for horizontal scanning direction | 【Note5-3】 |
| 19 | PS | I | Power save signal (Please don't carry out use by "Low" fixation) | |
| 20 | REV | I | reverse control signal | 【Note5-4】 |
| 21 | DGND | - | Ground(digital) | |
| 22 | B5 | I | BLUE data signal(MSB) | |
| 23 | B4 | I | BLUE data signal | |
| 24 | B3 | I | BLUE data signal | |
| 25 | B2 | I | BLUE data signal | |
| 26 | B1 | I | BLUE data signal | |
| 27 | B0 | I | BLUE data signal(LSB) | |
| 28 | LP | I | Data latch signal of source driver | |
| 29 | DGND | - | Ground(digital) | |
| 30 | SPL | I/O | Sampling start signal | |
| 31 | DGND | - | Ground(digital) | |
| 32 | DCLK | I | Data sampling clock signal | |
| 33 | DGND | - | Ground(digital) | |
| 34 | G5 | I | GREEN data signal(MSB) | |
| 35 | G4 | I | GREEN data signal | |
| 36 | G3 | I | GREEN data signal | |
| 37 | G2 | I | GREEN data signal | |
| 38 | G1 | I | GREEN data signal | |
| 39 | G0 | I | GREEN data signal(LSB) | |

| Pin No. | Symbol | I/O | Description | Remarks |
|---------|--------|-----|---|------------------|
| 40 | DGND | - | Ground(digital) | |
| 41 | R5 | I | RED data signal(MSB) | |
| 42 | R4 | I | RED data signal | |
| 43 | R3 | I | RED data signal | |
| 44 | R2 | I | RED data signal | |
| 45 | R1 | I | RED data signal | |
| 46 | R0 | I | RED data signal(LSB) | |
| 47 | AGND | - | Ground(analog) | |
| 48 | COM | O | Produce REV signal with the amplitude of AGND- VSHA | 【Note5-4】 |
| 49 | DGND | - | Ground(digital) | |
| 50 | DGND | - | Ground(digital) | |

【Note5-1】 Selection for vertical scanning direction

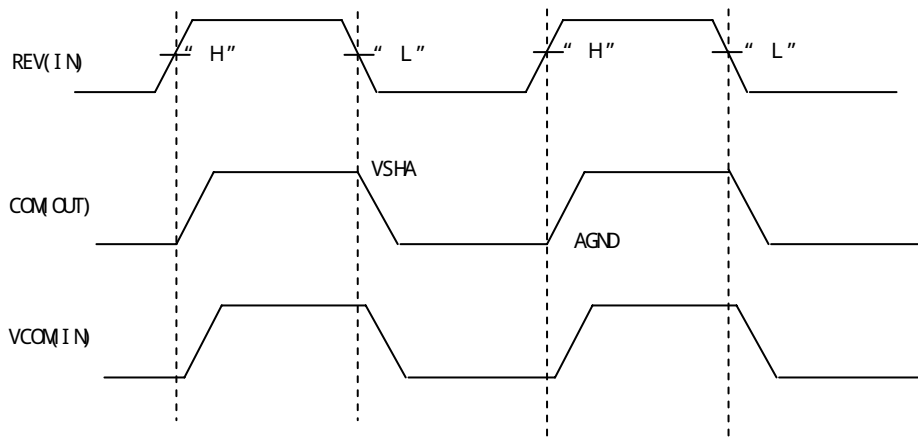
| U/L | Scanning direction (Pixel configuration) |
|------|---|
| Low | Normal scanning (X , 1) ↓ (X , 320) |
| High | Inverted scanning (X , 1) ↑ (X , 320) |

【Note5-2】 See section(7-1)-(A) ”※ Cautions when you turn on or off the power supply”.

【Note5-3】 Selection for horizontal scanning direction

| LBR | SPL | SPR | Scanning direction (Pixel configuration) |
|------|--------|--------|--|
| High | Input | Output | Normal scanning (1,Y) → (240,Y) |
| Low | Output | Input | Inverted scanning (1,Y) ← (240,Y) |

【Note5-4】



5-2)Touch panel driving section

Table 4

Recommendation CN : 0.4(1.0)9FLH-RSM1-TB (JST) A

| Pin No. | Symbol | I/O | Description | Remark |
|---------|--------|-----|---------------------|---|
| T1 | YU | - | Y (12 o'clock side) | |
| T2 | XL | - | X (right side) | A |
| T3 | YD | - | Y (6 o'clock side) | |
| T4 | XR | - | X (left side) | A |

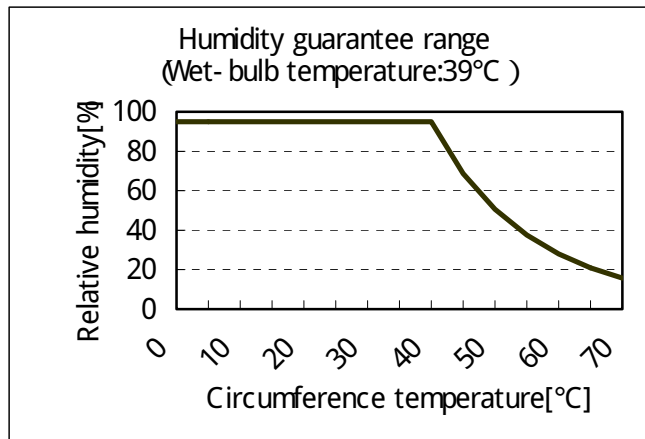
(6)Absolute Maximum Ratings

Table 5

| Parameter | Symbol | Condition | Ratings | Unit | Remark |
|---|---------|-----------|-----------------|------|------------------|
| Power supply(source/Analog) | VSHA | Ta=25°C | -0.3 ~ +7.0 | V | |
| Power supply(source/Digital) | VSHD | Ta=25°C | -0.3 ~ +7.0 | V | |
| Power supply (gate) | VDD | Ta=25°C | -0.3 ~ +35.0 | V | |
| Power supply (gate) | VDD-VEE | Ta=25°C | -0.3 ~ +35.0 | V | |
| Input voltage (Digital) | VID | Ta=25°C | -0.3 ~ VSHD+0.3 | V | [Terminal①] |
| Operating temperature (panel surface) | T opp | - | -10 ~ 70 | °C | 【Note6】 |
| Storage temperature | T stg | - | -25 ~ 70 | °C | 【Note6-2】 |

[Terminal①] MOD,U/L,SPS,CLS,SPL,R0 ~ R5,G0 ~ G5,B0 ~ B5,LP,DCLK,LBR,SPR,PS,REV

【Note6-2】 Humidity: 95%RH Max.(at Ta ≤ 40°C). Maximum wet-bulb temperature is less than 39°C (at Ta > 40°C). Condensation of dew must be avoided.



The maximum humidity in the temperature

(7)Electrical characteristics

7-1)Recommended operating conditions

A) TFT-LCD panel driving section

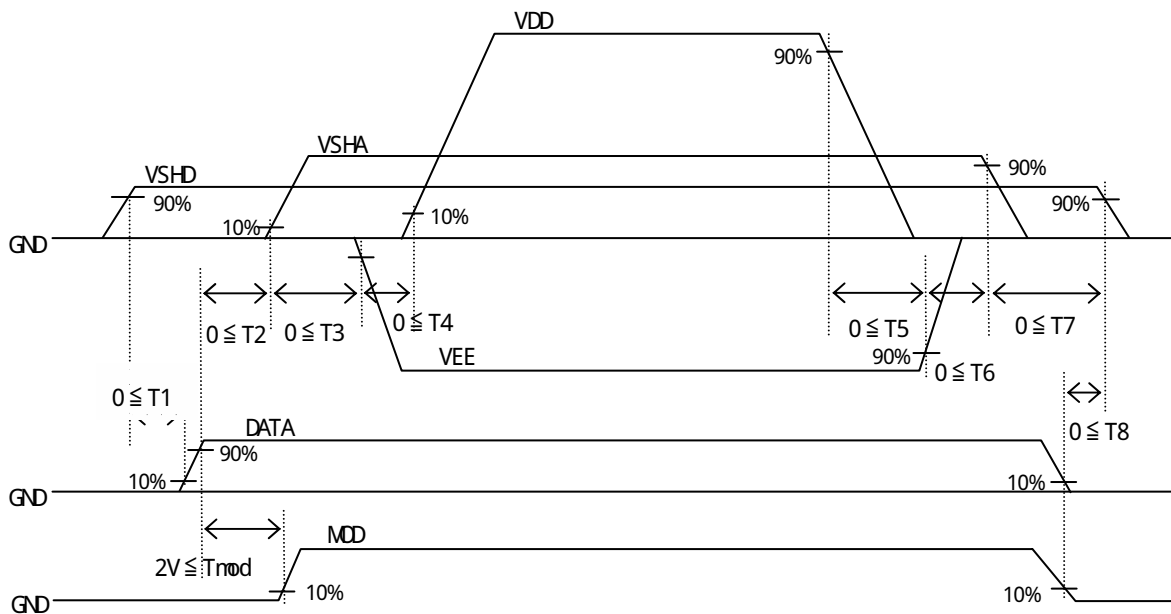
Table 6

GND=0V

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remarks | |
|--|--------------|---------|-------|---------|-------|------------|------------|
| Supply voltage for source driver (Analog) | VSHA | +4.5 | +5.0 | +5.5 | V | | |
| Supply voltage for source driver (Digital) | VSHD | +3.0 | +3.3 | +3.6 | V | | |
| Supply voltage for gate driver | High voltage | VDD | +14.5 | +15.0 | +15.5 | V | |
| | Low voltage | VEE | -10.5 | -10.0 | -9.5 | V | |
| Input voltage for Source driver (Low) | VILS | GND | - | 0.2VSHD | V | 【Note 7-1】 | |
| Input voltage for Source driver (High) | VIHS | 0.8VSHD | - | VSHD | V | 【Note 7-1】 | |
| Input current for Source driver (Low) | IILS | - | - | 30 | μ A | 【Note 7-1】 | |
| Input current for Source driver (High) | IHS1 | - | - | 30 | μ A | 【Note 7-2】 | |
| | IHS2 | - | - | 1200 | μ A | 【Note 7-3】 | |
| Input voltage for Gate driver (Low) | VILG | GND | - | 0.2VSHD | V | 【Note 7-4】 | |
| Input voltage for Gate driver (High) | VIHG | 0.8VSHD | - | VSHD | V | 【Note 7-4】 | |
| Input current for Gate driver (Low) | IILG | - | - | 4 | μ A | 【Note 7-4】 | |
| Input current for Gate driver (High) | IIHG | - | - | 4 | μ A | 【Note 7-4】 | |
| Common electrode driving signal | AC component | VCOMAC | - | ± 2.5 | ± 2.6 | Vp-p | 【Note 7-5】 |
| | DC component | VCOMDC | - 0.8 | +0.2 | +1.2 | V | 【Note 7-5】 |

※ Cautions when you turn on or off the power supply

- ① Turn on or off the power supply with simultaneously or the following sequence.
- ② The input signal of “MOD” Terminals(Pin No.11) must be low voltage when turning on the power supply, and it is held until more than double vertical periods after DATA is turned on completely. After then, it must be held high voltage until turning off the power supply.(Connect Pin No.11 terminals to the same signal.)



【Note 7-1】 DCLK,SPL,SPR,LBR,LP,PS,REV,R0 ~ R5,G0 ~ G5 and B0 ~ B5 terminals are applied.

【Note 7-2】 DCLK,SPL,SPR,LBR,LP,REV,R0 ~ R5,G0 ~ G5 and B0 ~ B5 terminals are applied.

【Note 7-3】 PS terminal is applied.

【Note 7-4】 MOD,CLS,SPS and U/L terminals are applied.

【Note 7-5】 VCOMAC should be alternated on VCOMDC every 1 horizontal period and 1 vertical period.

VCOMDC bias is adjusted so as to minimize flicker or maximum contrast every each module .

B) Back light driving section

Table 7

Ta=25°C

| Parameter | Symbol | MIN | TYP | MAX | Units | Remarks terminal |
|-------------------|--------|-----|-------|------|-------|------------------|
| LED voltage | VL | - | 21.6 | 25.2 | V | |
| LED current | IL | - | 15 | 20 | mA | |
| Power consumption | WL | - | 0.324 | - | W | 【Note 7-6】 |

【Note 7-6】 Calculated reference value(IL× VL)

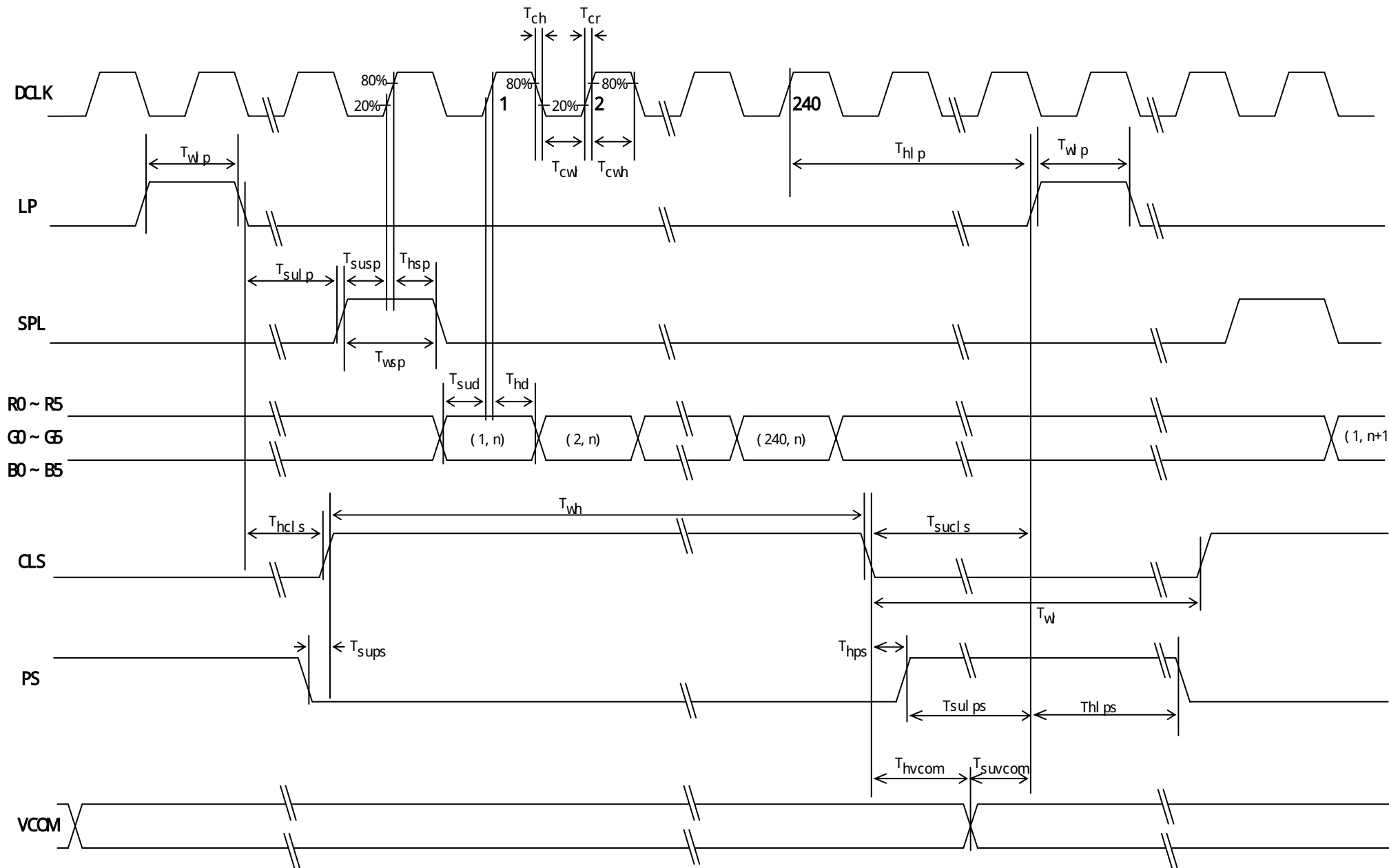


Fig.(a) Horizontal timing chart

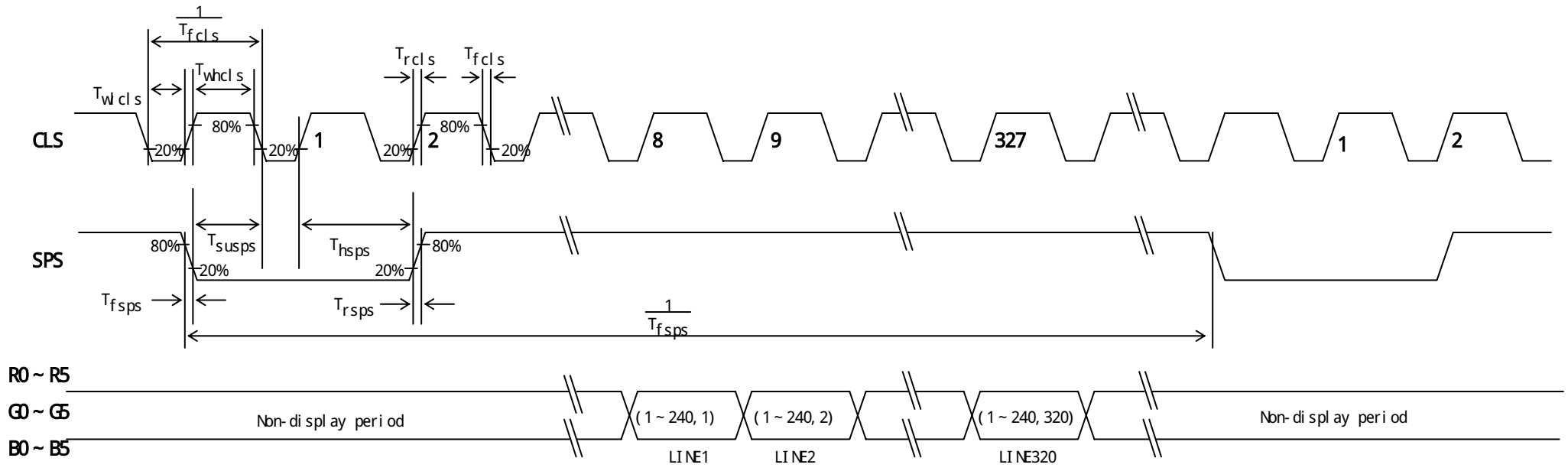


Fig.(b) Vertical timing chart

7-2) Timing Characteristics of input signals

Table 8 AC Characteristics (1)

(VSHA=+5V, VSHD=+3.3V, Ta=25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark | |
|----------------------------------|----------------------------|---------|------|------|-------------|-----------------|------------|
| Clock frequency of source driver | fCK | 4.5 | - | 6.8 | MHz | | |
| Source driver | Rising time of clock | Tcr | - | - | 20 | ns | DCLK |
| | Falling time of clock | Tcf | - | - | 20 | ns | |
| | Pulse width (High level) | Tcwh | 40 | - | - | ns | |
| | Pulse width (Low level) | Tcwl | 40 | - | - | ns | |
| | Frequency of start pulse | fsp | 16.5 | - | 28 | kHz | SPL,SPR |
| | Setup time of start pulse | Tsusp | 15 | - | - | ns | |
| | Hold time of start pulse | Thsp | 10 | - | - | ns | |
| | Pulse width of start pulse | Twsp | - | - | 1.5/fCK | ns | 【Note 7-7】 |
| | Setup time of latch pulse | Tsulp | 20 | - | - | ns | LP |
| | Hold time of latch pulse | Thlp | 20 | - | - | ns | |
| | Pulse width of latch pulse | Twlp | 60 | - | - | ns | |
| | Setup time of PS | Tsups | 0 | - | - | μs | PS |
| | Setup time of PS | Tsulps | 1 | - | - | μs | |
| | Hold time of PS | Thps | 0 | - | - | μs | |
| Hold time of PS | Thlps | 30 | - | - | ns | | |
| Set up time of data | Tsud | 15 | - | - | ns | R0 ~ R5,G0 ~ G5 | |
| Hold time of data | Thd | 10 | - | - | ns | ,B0 ~ B5 | |
| Gate driver | Clock frequency | fcls | 16.5 | - | 28 | kHz | CLS |
| | Pulse width of clock(Low) | Twlcls | 5 | - | (1/fcls)-30 | μs | |
| | Pulse width of clock(High) | Twhcls | 30 | - | - | μs | |
| | Rising time of clock | Trcls | - | - | 100 | ns | |
| | Falling time of clock | Tfcls | - | - | 100 | ns | |
| | Setup time of clock | Tsucls | 3 | - | - | μs | |
| | Hold time of clock | Thcls | 0 | - | - | μs | SPS |
| | Frequency of start pulse | fsps | 58 | - | 86 | Hz | |
| | Setup time of start pulse | Tsusps | 100 | - | - | ns | |
| | Hold time of start pulse | Thsps | 300 | - | - | ns | |
| | Rising time of start pulse | Trsps | - | - | 100 | ns | |
| Falling time of start pulse | Tfsps | - | - | 100 | ns | | |
| Vcom | Setup time of Vcom | Tsuvcom | 0 | - | - | μs | Vcom |
| | Hold time of Vcom | Thvcom | 1 | - | - | μs | |

【Note 7-7】 There must be only one up-edge of DCLK (includes Tsusp and Thsp time) in the period of SPL="Hi".



7-3)Power consumption

Measurement condition : SPS=60Hz,CLS=15.73kHz,SPL=15.73kHz,DCLK=6.3MHz

 The term of PS="Lo" in one horizontal period ... 37 μ sec(234DCLK)

Ta=25°C

Table 9

when normal scan mode

| Parameter | | Sym | Conditions | MIN | TYP | MAX | Unit | Remarks |
|----------------|---------|------|------------|-----|--------|--------|------|------------|
| Source current | Analog | ISHA | VSHA=+5.0V | - | 3.0 | 6.0 | mA | 【Note 7-8】 |
| | Digital | ISHD | VSHD=+3.3V | - | 1.5 | 3.0 | mA | 【Note 7-8】 |
| Gate current | High | IDD | VDD=+15.0V | - | 0.05 | 0.10 | mA | 【Note 7-9】 |
| | Low | IEE | VEE=-10.0V | - | - 0.05 | - 0.10 | mA | 【Note 7-9】 |

【Note 7-8】 Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42) every 1 dot.

【Note 7-9】 64-Gray-bar vertical pattern (GS0 ~ GS63 for horizontal way)

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

Table 10

| | 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

9-1)Not driving the Back light condition

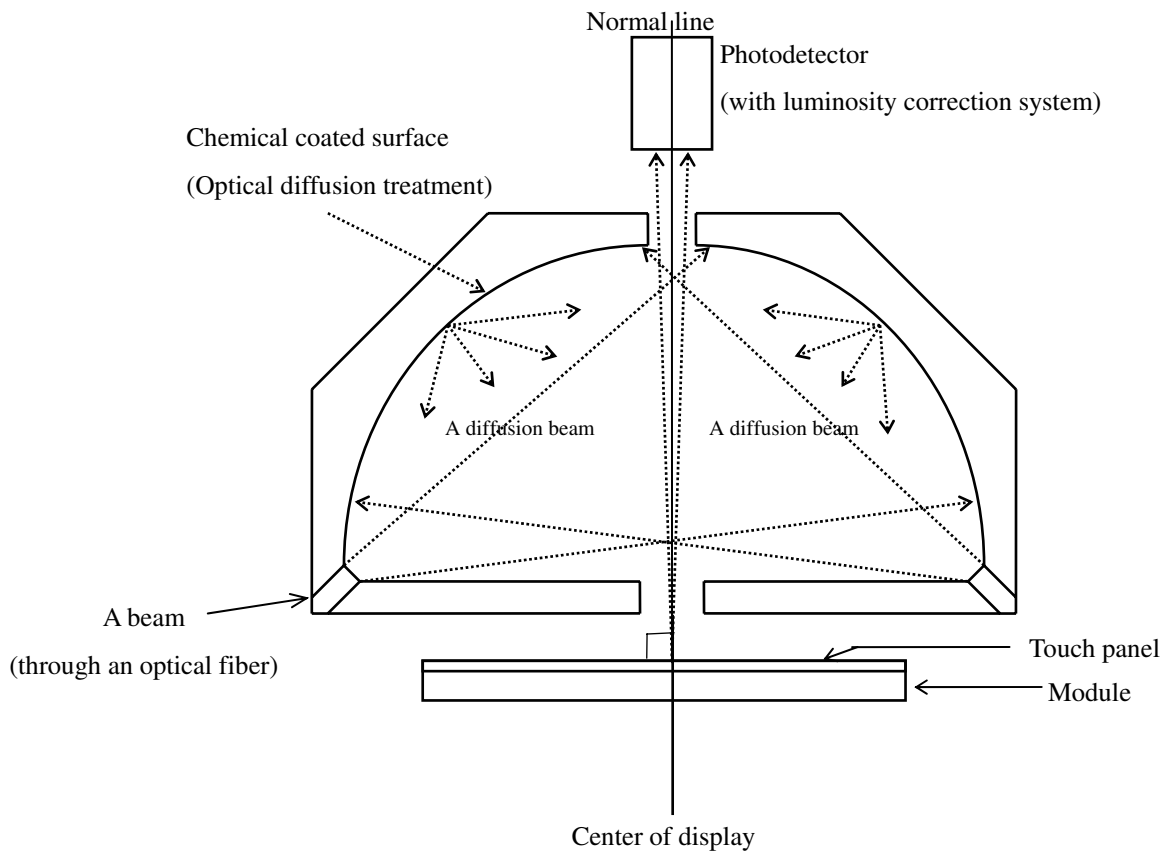
Table 11

(VSHA=+5V, VSHD=+3.3V, VDD=+15V, VEE=-10V ,Ta=25°C)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Remarks |
|---------------------|------------------|--------------------|------|----------|------|--------|--------------|
| Viewing angle range | $\theta_{21,22}$ | CR \geq 2 | 35 | 50 | - | degree | [Note 9-1,2] |
| | θ_{11} | | 35 | 50 | - | degree | |
| | θ_{12} | | 35 | 50 | - | degree | |
| Contrast ratio | CRmax | $\theta = 0^\circ$ | 3 | 4 | - | | [Note 9-2,4] |
| Response time | Rise | τ_r | - | 30 | 60 | ms | [Note 9-3] |
| | Fall | | | τ_d | 50 | 100 | |
| White chromaticity | x | $\theta = 0^\circ$ | 0.27 | 0.32 | 0.37 | | [Note 9-4] |
| | y | | 0.30 | 0.35 | 0.40 | | |
| Reflection ratio | R | $\theta = 0^\circ$ | 2.5 | 4 | - | % | [Note 9-5] |

* The measuring method of the optical characteristics is shown by the following figure.

* A measurement device is Otsuka luminance meter LCD5000.(With the diffusion reflection unit.)



Measuring method (a) for optical characteristics

9-2)Driving the Back light condition

Table 12

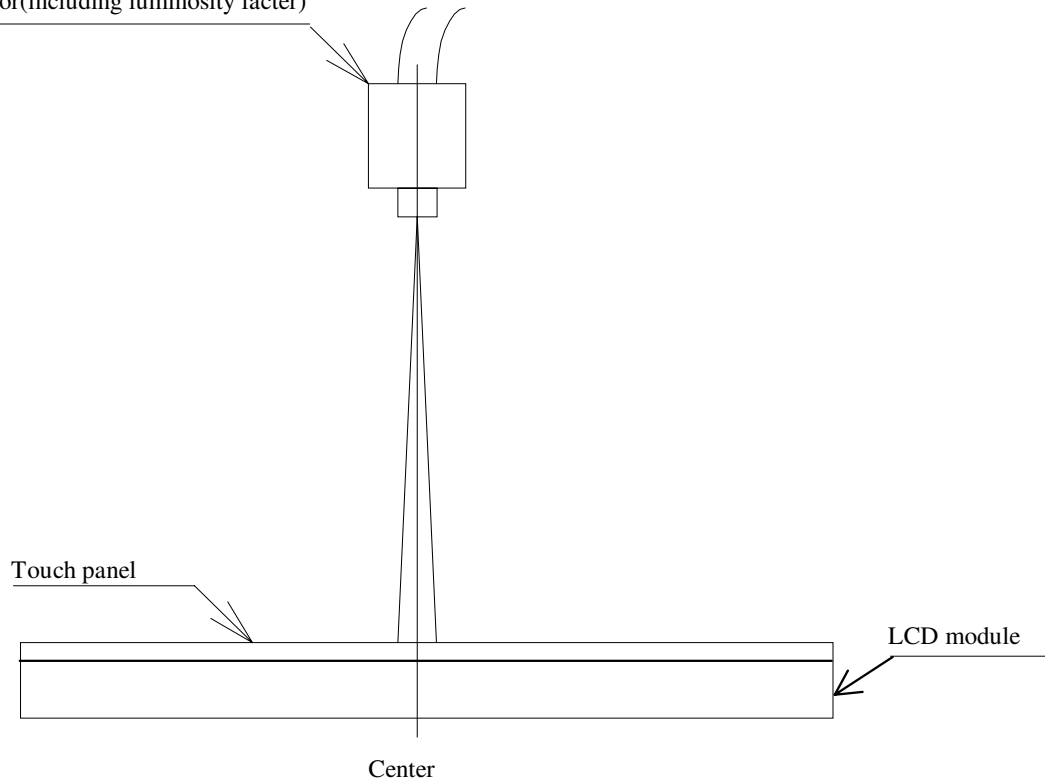
(VSHA=+5V, VSHD=+3.3V, VDD=+15V, VEE=-10V ,Ta=25°C)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Remarks | |
|---------------------|--------|-----------|------|-------|------|--------|----------------|------------|
| Viewing angle range | θ1,2 | CR≥2 | 30 | 40 | - | degree | [Note 9-1,2,6] | |
| | θ11 | | 40 | 50 | - | degree | | |
| | θ12 | | 30 | 40 | - | degree | | |
| Contrast ratio | Crmax | θ = 0° | 40 | 70 | - | | [Note 9-2] | |
| Response time | Rise | | τ r | - | 30 | 60 | ms | [Note 9-3] |
| | Fall | | τ d | - | 50 | 100 | ms | |
| White chromaticity | x | | 0.25 | 0.30 | 0.35 | | | |
| | y | 0.28 | 0.33 | 0.38 | | | | |
| Brightness | Y | θ = 0° | 75 | 100 | - | cd/m2 | IL=18mA | |
| LED life time | LL | IL=15mA | - | 10000 | - | hour | [Note 9-7] | |

* The measuring method of the optical characteristics is shown by the following figure.

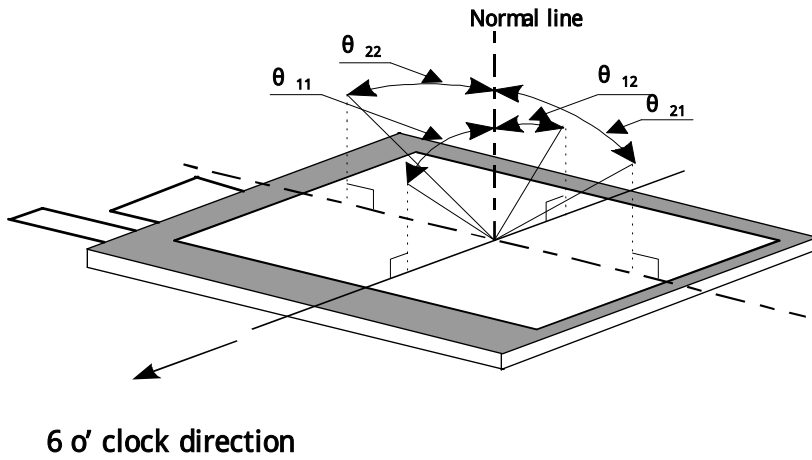
* A measurement device is TOPCON luminance meter BM-5(A).(Viewing cone 1)

Photodetector(including luminosity factor)



Measuring method (c) for optical characteristics

[Note 9-1] Viewing angle range is defined as follows.



Definition for viewing angle

[Note 9-2] Definition of contrast ratio:

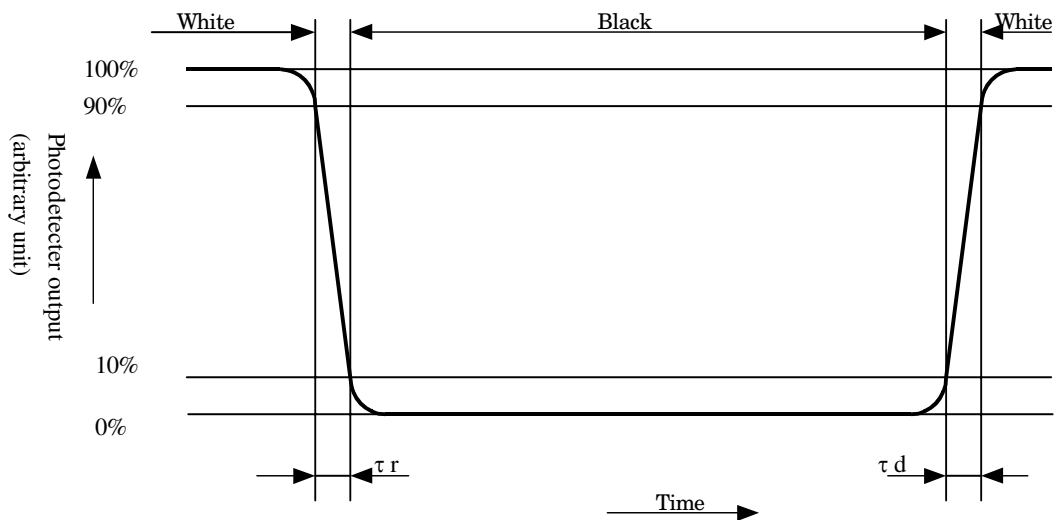
The contrast ratio is defined as follows:

$$\text{Contrast ratio(CR)} = \frac{\text{Photodetector output with all pixels white(GS63)}}{\text{Photodetector output with all pixels black(GS0)}} \times 100\%$$

$V_{COMAC} = 5.0V_{p-p}$

[Note 9-3] 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".



[Note 9-4] A measurement device is Minolta CM-2002.

[Note 9-5] Definition of reflection ratio

$$\text{Reflection ratio} = \frac{\text{Light detected level of the reflection by the LCD module}}{\text{Light detected level of the reflection by the standard white board}}$$

[Note 9-6] A measurement device is ELDIM EZContrast

[Note 9-7] This is the reference value. The White-LED life time is defined as a time when brightness not to become under 50% of the original value(at Ta=25°C)

(10)Touch panel characteristics

Table 13

| Parameter | Min. | Typ. | Max. | Unit | Remark |
|-----------------------------------|------|------|------|------|---------------------------|
| Input voltage | - | 5.0 | 7.0 | V | |
| Resistor between terminals(XL-XR) | 200 | - | 640 | Ω | Provisional specification |
| Resistor between terminals(YU-YD) | 150 | - | 550 | Ω | |
| Line linearity(X direction) | - | - | 1.5 | % | |
| Line linearity(Y direction) | - | - | 1.5 | % | |
| Insulation resistance | 20 | - | - | MΩ | at DC25V |
| Minimum tension for detecting | - | - | 0.79 | N | |

(11)Display quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standards for TFT-LCD..

(12)Mechanical characteristics

12-1) External appearance

See Fig. 1

12-2) FPC (for LCD panel) characteristics

(1)Specific connector

FH12A-50S-0.5SH(HIROSE)

(2) Bending endurance of the bending slits portion

No line of the FPC is broken for the bending test (Bending radius=0.6mm and angle=90°) in 30 cycles.

12-3) Design guidance for touchpanel(T/P)

12-3-1)Example of housing design

(1)If a consumer will put a palm on housing in normal usage, care should be taken as follows.

(2)Keep the gap, for example 0.3 to 0.7mm,between bezel edge and T/P surface.

The reason is to avoid the bezel edge from contacting T/P surface that may cause a "short" with bottom layer(See Fig.2)

(3)Insertion a cushion material is recommended.

(4)The cushion material should be limited just on the busbar insulation paste area.

If it is over the transparent insulation paste area, a "short" may be occurred.

(5)There is one where a resistance film is left in the T/P part of the end of the pole.

Design to keep insulation from the perimeter to prevent from mis-operation and so on.

12-3-2) Mounting on display and housing bezel

- (1) In all cases, the T/P should be supported from the backside of the Plastic.
- (2) Do not use an adhesive-tape to bond it on the front of T/P and hang it to the housing bezel.
- (3) Never expand the T/P top layer (PET-film) like a balloon by internal air pressure.

The life of the T/P will be extremely short.

- (4) Top layer, PET, dimension is changing with environmental temperature and humidity.

Avoid a stress from housing bezel to top layer, because it may cause "waving".

- (5) The input to the Touchpanel sometimes distorts touch panel itself.

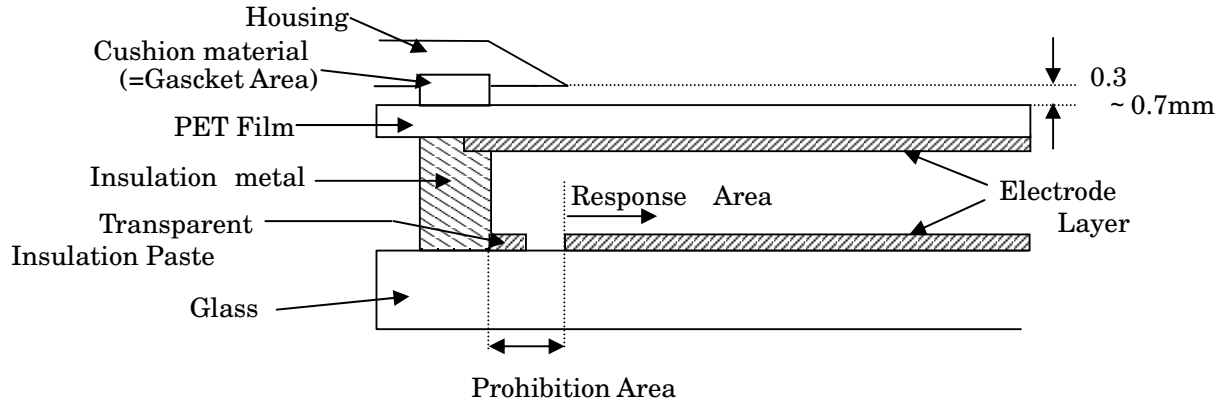


Fig.2

(13) Handling Precautions

13-1) Insertion and taking out of FPCs

Be sure insert and take out of the FPC into the connector of the set after turning off the power supply on the set side.

13-2) Handling of FPCs

The FPC for LCD panel shall be bent only slit portion. The bending slit shall be bent uniformly on the whole slit portion with bending radius larger than 0.6mm ,and only inner side (back side of the module). Don't bend it outer side (display surface side).

Don't give the FPCs too large force, for example, hanging the module with holding FPC.

13-3) Installation of the module

On mounting the module, be sure to fix the module on the same plane. Taking care not to warp or twist the module.

13-4) Precaution when mounting

- (1) If water droplets and oil attaches to it for a long time, discoloration and staining occurs. Wipe them off immediately.
- (2) Glass is used for the TFT-LCD panel. If it is dropped or bumped against a hard object, it may be broken. Handle it with sufficient care.
- (3) As the CMOS IC is used in this module, pay attention to static electricity when handling it. Take a measure for grounding on the human body.

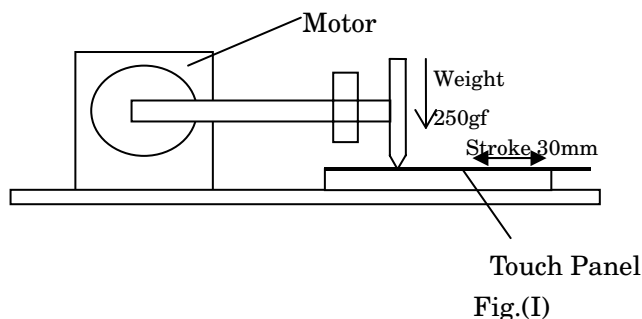
13-5) Others

- (1) The liquid-crystal is deteriorated by ultraviolet rays. Do not leave it in direct sunlight and strong ultraviolet rays for many hours.
- (2) If it is kept at a temperature below the rated storage temperature, it becomes coagulated and the panel may be broken. Also, if it is kept at a temperature above the rated storage temperature, it becomes isotropic liquid and does not return to its original state. Therefore, it is desirable to keep it at room temperature as much as possible.
- (3) If the LCD breaks, don't put internal liquid crystal into the mouth. When the liquid crystal sticks to the hands, feet and clothes, wash it out immediately.
- (4) Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots.
- (5) Observe general precautions for all electronic components.
- (6) VCOM must be adjusted on condition of your final product. No adjustment causes the deterioration for display quality.
- (7) Static image should not be displayed more than 5 minutes in order to prevent from occurrence of residual image.
- (8) If local pressure joins T/P surface for a long time, it will become the cause of generating of Newton's ring.

(14)Reliability Test Conditions for TFT-LCD Module

Table 14

| No. | Test items | Test conditions |
|-----|---|---|
| 1 | High temperature storage test | Ta=+70°C 240h |
| 2 | Low temperature storage test | Ta=-25°C 240h |
| 3 | High temperature and high humidity operating test | Tp=+40°C , 95%RH 240h (But no condensation of dew) |
| 4 | High temperature operating test | Tp=+70°C 240h |
| 5 | Low temperature operating test | Tp=-10°C 240h |
| 6 | Electro static discharge test | ± 200V · 200pF(0Ω) to Terminals(Contact) (1 time for each terminals) ± 8kV · 150pF(330Ω) to Housing bezel or TP(Contact) ± 15kV · 150pF(330Ω) to Housing bezel or TP(in Air) |
| 7 | Shock tset | 980 m/s ² , 6 ms ± X,± Y,± Z 3 times for each direction (JIS C0041, A-7 Condition C) |
| 8 | Vibration test | Frequency range: 10Hz ~ 55Hz Stroke: 1.5 mm Sweep: 10Hz ~ 55Hz X,Y,Z 2 hours for each direction (total 6 hours) (JIS C0040,A-10 Condition A) |
| 9 | Heat shock test | Ta=-25°C ~ +70°C / 5 cycles (1h) (1h) |
| 10 | Point activation test (Touch panel) | Hit it 1,000,000 times with a silicon rubber of R8 HS 60. Hitting force :2.4N Hitting speed : 3 times per second |
| 11 | Writing friction resistance test (Touch panel) | Write according to the right illustration in the undermentioned conditions: Pen : 0.8R Polyacetal stylus Load : 2.4N Speed : 3 strokes per second Stroke : 30mm Frequency : 100000 times Testing apparatus : shown in Fig (I) |
| 12 | FPC Bending Test | Bending 30 times by bending radius R0.6mm and angle=90° (LCD FPC) Bending 10 times by bending radius R1.0mm (T/P FPC) |



【Note】 Ta = Ambient temperature, Tp = Panel temperature

【Check items】

(a)Test No.1 ~ 9

In the standard condition, there shall be no practical problems that may affect the display function.

(b)Test No.10 ~ No.11

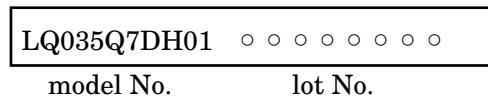
The measurements after the tests are satisfied (10)-Table 13 (Touch panel characteristics)

(15) Others

15-1)Indication of lot number

The lot number is shown on a label. Attached location is shown in Fig.1 (Outline Dimensions).

Indicated contents of the label



15-2) Used Regulation of Chemical Substances Breaking Ozone Stratum

Substances with the object of regulating : CFCS, Carbon tetrachloride, Halon

1,1,1-Trichloro ethane (Methyl chloroform)

- (a) This LCD module, Constructed part and Parts don't contain the above substances.
- (b) This LCD module, Constructed part and Parts don't contain the above substances in processes of manufacture.

15-3) If some problems arise about mentioned items in this document and other items, the user of the TFT-LCD module and Sharp will cooperate and make efforts to solve the problems with mutual respect and good will.

16)Forwarding form(see Fig. 3 Package Form)

- a) Piling number of cartons : Max 20
- b) Package quality in one cartons : 50pcs
- c) Carton size : 562mm x 311mm x 75mm
- d) Total mass of 1 carton filled with full modules : 3550g

Conditions for storage.

Environment

- (1)Temperature : 0 ~ 40°C
- (2)Humidity : 60%RH or less (at 40°C)
No dew condensation at low temperature and high humidity.
- (3)Atmosphere : Harmful gas, such as acid or alkali which bites electronic components and/or wires, must not be detected.
- (4)Period : about 3 months
- (5)Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc

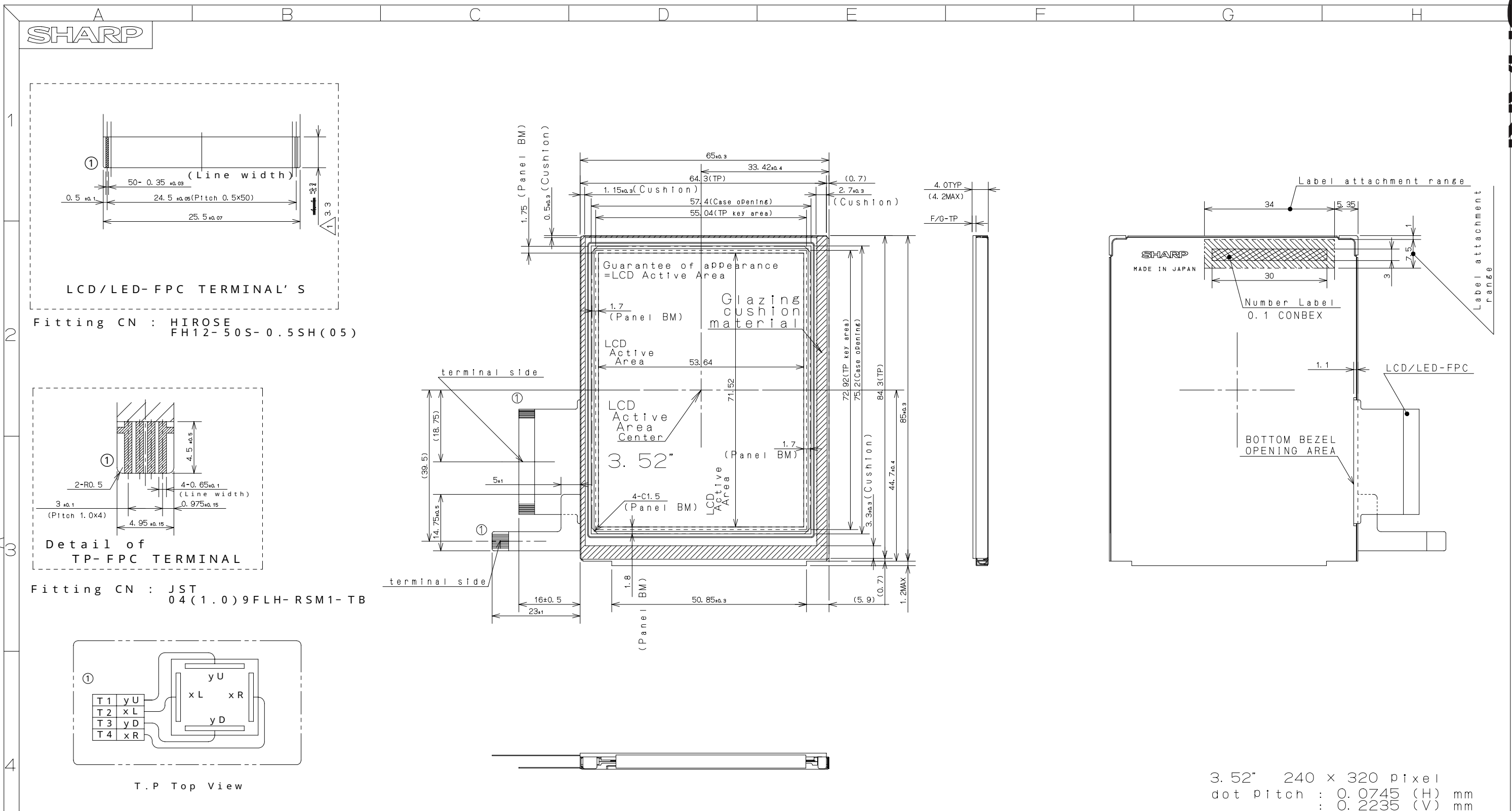


Fig.1 Outline Dimension

- General tolerance is ±0.5mm
- LCD/LED-FPC bend radius: Min.0.6mm
- TP-FPC bend radius: Min.1mm
- Take care in set design to hide the scratches and bubbles appeared on the polarizer or other frame area which is located outside of guarantee area.
- The light of Back Light is leaking from BM outside, please light shielding by the set.
- The tolerance of module width are exclude warp of case.
- Glazing cushion material should be limited just on the busbar insulation paste area.

Unit is mm

| | | | | | |
|---|------------|------------------------------|----------|-------------------|---------------------|
| 5 | | | | ORIGINAL MODEL | LQ035Q7DH01 |
| 4 | | | | 画面サイズ | 89.4(3.52") |
| 3 | | | | ACTIVE AREA SIZE | 0.2235mm 240RGB×320 |
| 2 | | | | 尺度 SCALE | 1/1 |
| 1 | 2003.10.20 | Changing of LCD FPC TERMINAL | Y. T | 日付 DATE | 13. Jun. 2003 |
| | 改訂日 | 改訂記事 | REVISION | 単位 Unit | mm |
| | 設計 | 製図 | 検図 | 検図 | 承認 |
| | DESIGNER | DRAFTER | DSN CK | DSN CK | ENG APPD |
| | Y. Takao | | | SHARP CORPORATION | |
| | | | | 名称 NAME | Outline Dimensions |
| | | | | ユーザー USER | |
| | | | | 原紙サイズ | A4 |
| | | | | 図番 DRAWING NO | LDM-1030016B |