

# **LQ050Q5DR01**

## **TFT-LCD Module**

Spec. Issue Date: August 11, 2005

No: LCY-02002A

|                                    |      |                                                                                                                                                                        |                                                            |
|------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
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|                                    |      |                                                                                                                                                                        | APPLICABLE GROUP<br>MOBILE LIQUID CRYSTAL<br>DISPLAY GROUP |

DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LQ050Q5DR01

CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

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## RECORDS OF REVISION

MODEL No : LQ050Q5DR01

SPEC No : LCY-02002A

[illegible]

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## (1) Application

This specification literature applies to color TFT-LCD module ,LQ050Q5DR01.

## (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-PWB, FPC, frame, front shielding case, back-light unit.

Graphics and texts can be displayed on a  $320 \times 3 \times 240$  dots panel with 262,144 colors by supplying.

DC/AC inverter isn't composed.

The 5 screen produces a high resolution image that is composed of 76,800 pixel elements in a stripe arrangement.

Wide viewing angle technology is employed. (The most suitable viewing angle is in the 6 o'clock direction.)

By adopting an active matrix drive, a picture with high contrast is realized.

Through the use of TN-normally white mode, an image with highly natural color image is realized.

It is used the Low-reflection (LR) and an antiglare (AG) surface polarization plate.

An inverted video display in the vertical and horizontal directions is possible.

This module is adapted to RoHS compliance.

## (3) Mechanical specifications

table 3-1

| Parameter              | Specifications                           | Units  | Remarks   |
|------------------------|------------------------------------------|--------|-----------|
| Display format         | 76,800                                   | pixels |           |
|                        | $320(W) \times RGB \times 240(H)$        | dots   |           |
| Active area            | $101.28 (W) \times 74.76 (H)$            | mm     |           |
| Screen size (Diagonal) | 12.6 [4.96"]                             | cm     |           |
| Dot pitch              | $0.1055 (W) \times 0.3115 (H)$           | mm     |           |
| Pixel configuration    | R,G,B Stripe configuration               |        |           |
| Outline dimension      | $119.4(W) \times 89.1(H) \times 12.7(D)$ | mm     | 【Note3-1】 |
| Mass                   | MAX 170                                  | g      |           |
| Surface treatment      | AG+LR                                    |        |           |

## 【Note 3-1】

Typical values are given. For detailed measurements and tolerances, please refer to Fig. 1.

## (4)Input terminal

## 4-1)TFT-LCD panel driving part

Used connector: KX14-40K5D-VIE (JAE Co. , Ltd)

Fit connector : KX15-40KLDL-VIE (JAE Co. , Ltd)

Table 4-1

CN1

【Note4-6】

| Pin No. | Symbol | Description                                              | Remarks   |
|---------|--------|----------------------------------------------------------|-----------|
| 1       | GND    | ground                                                   |           |
| 2       | VCC    | Power supply voltage                                     |           |
| 3       | Hsync  | Horizontal synchronous signal                            | 【Note4-1】 |
| 4       | G3     | GREEN data signal                                        |           |
| 5       | T0     | thermistor output1                                       |           |
| 6       | G4     | GREEN data signal                                        |           |
| 7       | T1     | thermistor output2                                       |           |
| 8       | G5     | GREEN data signal(MSB)                                   |           |
| 9       | HVR    | Selection for horizontal and vertical scanning direction | 【Note4-3】 |
| 10      | GND    | ground                                                   |           |
| 11      | GND    | ground                                                   |           |
| 12      | B0     | BLUE data signal(LSB)                                    |           |
| 13      | CLK    | Clock signal for sampling each data signal               |           |
| 14      | B1     | BLUE data signal                                         |           |
| 15      | GND    | ground                                                   |           |
| 16      | B2     | BLUE data signal                                         |           |
| 17      | R0     | RED data signal(LSB)                                     |           |
| 18      | GND    | ground                                                   |           |
| 19      | R1     | RED data signal                                          |           |
| 20      | B3     | BLUE data signal                                         |           |
| 21      | R2     | RED data signal                                          |           |
| 22      | B4     | BLUE data signal                                         |           |
| 23      | GND    | ground                                                   |           |
| 24      | B5     | BLUE data signal(MSB)                                    |           |
| 25      | R3     | RED data signal                                          |           |
| 26      | GND    | ground                                                   |           |
| 27      | R4     | RED data signal                                          |           |
| 28      | Vsync  | Vertical synchronous signal                              | 【Note4-1】 |
| 29      | R5     | RED data signal(MSB)                                     |           |
| 30      | TEST   | Open use only                                            |           |
| 31      | GND    | Ground                                                   |           |
| 32      | TEST   | Open use only                                            |           |
| 33      | G0     | GREEN data signal(LSB)                                   |           |
| 34      | TEST   | Open use only                                            |           |
| 35      | G1     | GREEN data signal                                        |           |
| 36      | TEST   | Open use only                                            |           |
| 37      | G2     | GREEN data signal                                        |           |
| 38      | ENAB   | Signal to settle the horizontal display position         | 【Note4-2】 |
| 39      | VCC    | Power supply voltage                                     |           |
| 40      | GND    | ground                                                   |           |

## 【Note 4-1】

|       |          |
|-------|----------|
| Hsync | positive |
| Vsync | positive |

## 【Note 4-2】

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 Fig3-A.  
(Don't keep ENAB "High" during operation.(Fig3-B).)

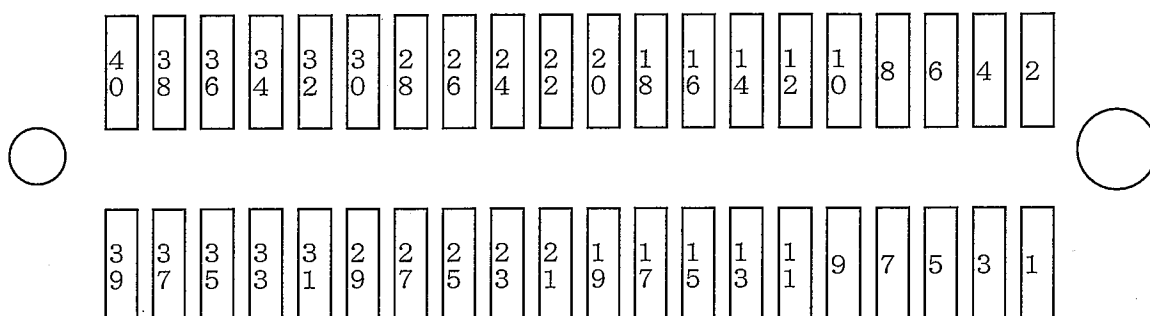
## 【Note 4-3】

HVR = "Low" : Regular video

HVR = "High" : Horizontally and Vertically inverted video

## 【Note 4-4】

The position of pin number



## 4-2) Back-light fluorescent tube driving part

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

Fit connctor:SM02(8.0)B-BHS-1N(JST Co.,Ltd)

Table 4-2

| No. | Symbol | i / o | Function                      | Color of FL cable |
|-----|--------|-------|-------------------------------|-------------------|
| 1   | VL1    | I     | input terminal (High Voltage) | RED               |
| 2   | VL2    | I     | input terminal (Low Voltage)  | BLACK             |

Caution : Please use this thermistor in order to check the lamp temperature.

Model number of Thermistor :203GT-1 (made by Ishizuka electronics Corporation)

Zero load resistance value at 25°C : 20.0kΩ ± 3 %

## (5)Absolute maximum ratings

Table 5-1

GND = 0 V

| Parameter                                        | Symbol            | MIN  | MAX     | Unit | Note               |
|--------------------------------------------------|-------------------|------|---------|------|--------------------|
| Input voltage                                    | V <sub>I</sub>    | -0.3 | VCC+0.3 | V    | 【Note 5-1】 Ta=25°C |
| +3.3V power supply                               | VCC               | 0    | 5.5     | V    | Ta=25°C            |
| Storage temperature                              | T <sub>stg</sub>  | -40  | +95     | °C   | 【Note 5-2】         |
| Operating temperature<br>(panel surface)         | T <sub>opr1</sub> | -30  | +85     | °C   | 【Note 5-2】         |
| Operating temperature<br>( Ambient temperature ) | T <sub>opr2</sub> | -30  | +60     | °C   | 【Note 5-2】         |

【Note 5-1】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,HVR

【Note 5-2】 Humidity:95%RH Max. at Ta≤60°C

Maximum wet-bulb temperature is less than 58°C. at Ta>60°C.

Condensation of dew must be avoided as electrical current leaks will occur,  
Causing a degradation of performance specifications.

(6)Electrical characteristics  
6-1)TFT-LCD panel driving section

Table 6-1

GND=0V,  $T_a = 25^\circ\text{C}$ 

| Parameter               |                     | Symbol          | MIN                | TYP  | MAX                | Unit | Remarks                                       |
|-------------------------|---------------------|-----------------|--------------------|------|--------------------|------|-----------------------------------------------|
| +3.3V                   | Supply voltage      | V <sub>CC</sub> | +2.9               | +3.3 | +3.7               | V    | 【Note 6-1】                                    |
|                         | Current dissipation | I <sub>CC</sub> | —                  | 140  | 180                | mA   | 【Note 6-2,3】                                  |
| Permissive input ripple |                     | V <sub>RF</sub> | —                  | —    | 100                | mVpp |                                               |
| Input Low voltage       |                     | V <sub>IL</sub> | —                  | —    | 0.3V <sub>CC</sub> | V    | 【Note 6-4】                                    |
| Input High voltage      |                     | V <sub>IH</sub> | 0.7V <sub>CC</sub> | —    | —                  | V    |                                               |
| Input current (Low)     |                     | I <sub>IL</sub> | —                  | —    | 1.0                | μA   | V <sub>I</sub> =0V<br>【Note 6-5】              |
| Input current (High)    |                     | I <sub>IH</sub> | 3.0                | —    | 75                 | μA   | V <sub>I</sub> =V <sub>CC</sub><br>【Note 6-5】 |
| Input current (Low)     |                     | I <sub>IL</sub> | 3.0                | —    | 75                 | μA   | V <sub>I</sub> =0V<br>【Note 6-6】              |
| Input current (High)    |                     | I <sub>IH</sub> | —                  | —    | 1.0                | μA   | V <sub>I</sub> =V <sub>CC</sub><br>【Note 6-6】 |
| Input current (Low)     |                     | I <sub>IL</sub> | 6.0                | —    | 150                | μA   | V <sub>I</sub> =0V<br>【Note 6-7】              |
| Input current (High)    |                     | I <sub>IH</sub> | —                  | —    | 2.0                | μA   | V <sub>I</sub> =V <sub>CC</sub><br>【Note 6-7】 |

## 【Note 6-1】

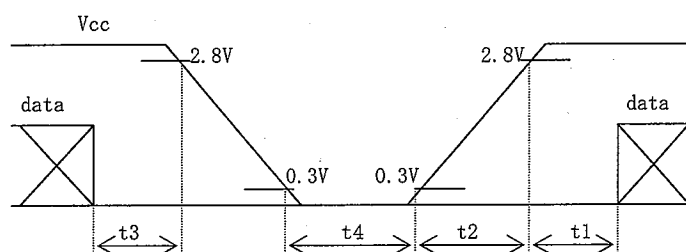
On-off conditions for supply voltage

$0 < t_1 \leq 10\text{ms}$

$0 < t_2 \leq 10\text{ms}$

$0 < t_3 \leq 1\text{s}$

$t_4 \geq 1\text{s}$



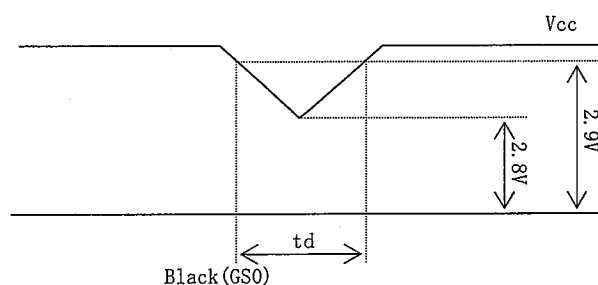
Vcc-dip conditions

1)  $2.8\text{V} \leq V_{CC} < 2.9\text{V}$

$t_d \leq 10\text{ms}$

2)  $V_{CC} < 2.8\text{V}$

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



## 【Note 6-2】

Typical current situation: Black (GS0) pattern

Timing: Typical

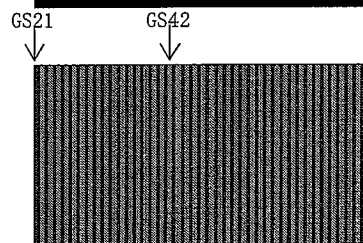
VCC= +3.3 V



【Note 6-3】 Maximum current situation: Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42) every 1 dot.

Timing: Typical

VCC= +3.3 V



【Note 6-4】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB,HVR

【Note 6-5】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync

【Note 6-6】 ENAB

【Note 6-7】 HVR

## 6-2) Backlight driving section

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

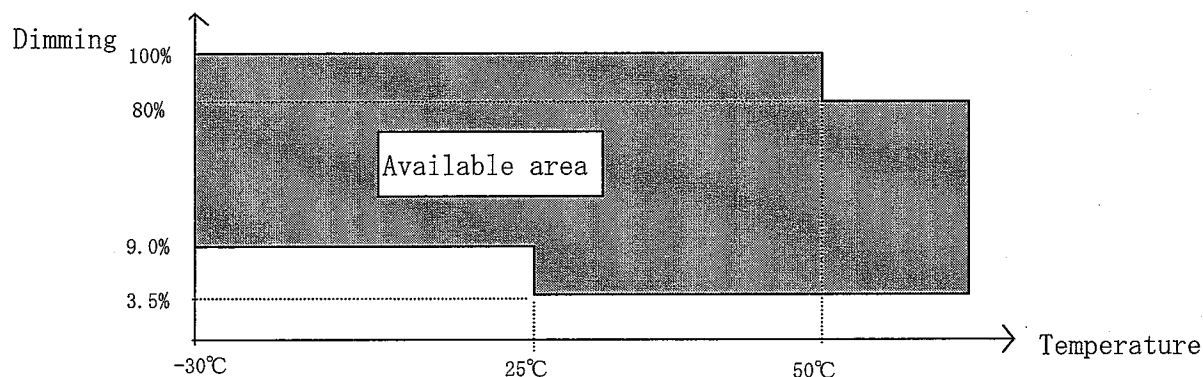
The characteristics of Lamp are shown in the following table.

Table 6-2

| Parameter        | Symbol | MIN | TYP | MAX  | Unit  | Remarks                         |
|------------------|--------|-----|-----|------|-------|---------------------------------|
| lamp voltage     | V L 7  | 600 | 670 | 740  | Vrms  | I L =5.5mArms                   |
| lamp current     | I L    | 5.0 | 5.5 | 6.0  | mArms | ordinary state                  |
|                  | I L B  | —   | —   | 9.0  | mArms | PWM dimming state<br>【Note 6-8】 |
| lamp frequency   | f L    | 30  | —   | 60   | kHz   |                                 |
| kick-off voltage | V S    | —   | —   | 2120 | Vrms  | Ta=+25°C                        |
|                  |        | —   | —   | 2170 | Vrms  | Ta=-30°C                        |

Inverter : HIU-288 [Harison Toshiba Lighting Corp.] (Output capasitor:22pF,frequency:49kHz)

【Note 6-8】 available area



\* Please turn on the lamp with symmetrical (negative and positive)voltage and current wave form  
Don't use the unsymmetrical voltage and current wave which have spike wave.

## 7) Timing Characteristics of input signals

Timing diagrams of input signal are shown in Fig.3-A, Fig.3-B.

## 7-1) Timing characteristics

Table 7-1

| Parameter                    | Symbol     | MIN  | TYP | MAX   | Unit | Remarks |
|------------------------------|------------|------|-----|-------|------|---------|
| Clock                        | frequency  | 1/Tc | 4.5 | 6.3   | 6.8  | MHz     |
|                              | High time  | Tch  | 50  | —     | —    | ns      |
|                              | Low time   | Tcl  | 50  | —     | —    | ns      |
| Data                         | Setup time | Tds  | 50  | —     | —    | ns      |
|                              | Hold time  | Tdh  | 50  | —     | —    | ns      |
| Hsync-Clock phase difference | THc        | 50   | —   | 120   | ns   |         |
| Hsync-Vsync phase difference | TVh        | 0    | —   | TH-10 | μs   |         |

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

## 7-2) Horizontal display position

## ①In case ENAB is active

The horizontal display position is determined by ENAB signal and the input data corresponding to the rising edge of ENAB signal is displayed at the left end of the active area. (shown in Fig.3-A.)

| Parameter                            |             | symbol          | Min.                 | Typ. | Max.               | Unit    | Remark |
|--------------------------------------|-------------|-----------------|----------------------|------|--------------------|---------|--------|
| Horizontal sync. signal              | Cycle       | TH              | 50                   | 63.5 | 80                 | $\mu s$ |        |
|                                      |             |                 | TH <sub>e</sub> +308 | 400  | 440                | clock   |        |
|                                      | Pulse width | TH <sub>p</sub> | 4                    | 12   | 30                 | clock   |        |
| Enable signal                        | Setup time  | T <sub>es</sub> | 50                   | —    | T <sub>c</sub> -10 | ns      |        |
|                                      | Pulse width | T <sub>ep</sub> |                      | 320  |                    | clock   |        |
| Hsync-Enable signal phase difference |             | TH <sub>e</sub> | 14                   | —    | 72                 | clock   |        |
| Horizontal display period            |             | TH <sub>d</sub> | 320                  | 320  | 320                | clock   |        |

## ②In case ENAB is "Low". (shown in Fig.3-B)

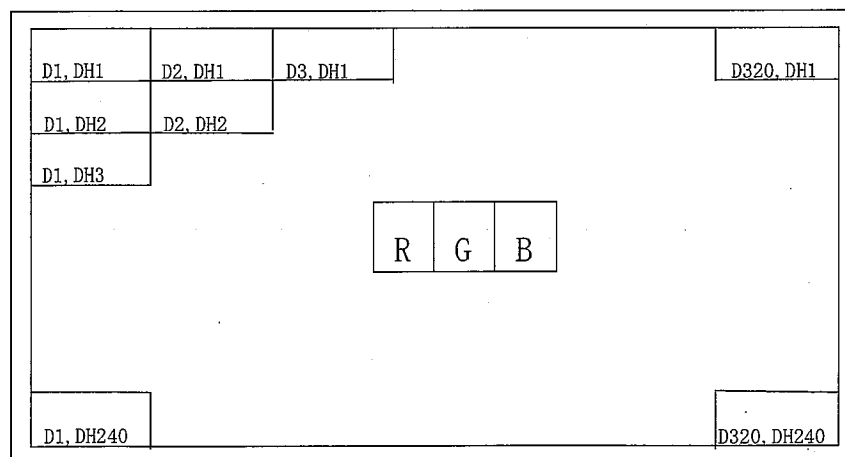
| Parameter                          |             | symbol          | Min. | Typ. | Max. | Unit    | Remark |
|------------------------------------|-------------|-----------------|------|------|------|---------|--------|
| Horizontal sync. signal            | Cycle       | TH              | 56   | 63.5 | 80   | $\mu s$ |        |
|                                    |             |                 | 380  | 400  | 440  | clock   |        |
|                                    | Pulse width | TH <sub>p</sub> | 4    | 12   | 30   | clock   |        |
| Hsync-data signal phase difference |             | TH <sub>e</sub> | 72   | 72   | 72   | clock   |        |
| Horizontal display period          |             | TH <sub>d</sub> | 320  | 320  | 320  | clock   |        |

## 7-3) Vertical display position

| Parameter                       |             | Symbol          | MIN | TYP | MAX | Unit | Remarks |
|---------------------------------|-------------|-----------------|-----|-----|-----|------|---------|
| Vertical sync. signal           | Cycle       | TV              | 246 | 263 | 330 | line |         |
|                                 | Pulse width | TV <sub>p</sub> | 1   | —   | —   | line |         |
| Vertical display start position |             | TV <sub>s</sub> | 6   | 6   | 6   | line |         |
| Vertical display period         |             | TV <sub>d</sub> | 240 | 240 | 240 | line |         |

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)

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

|                     | Colors &   | Data signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|---------------------|------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
|                     | Gray scale | 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  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Cyan       | —           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Red        | —           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Magenta    | —           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Yellow     | —           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 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  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ↓          | GS62        | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Red        | GS63        | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 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  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Darker     | GS2         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ↑          | ↓           | ↓  |    |    |    |    |    | ↓  |    |    |    |    |    | ↓  |    |    |    |    |    |   |
|                     | ↓          | ↓           | ↓  |    |    |    |    |    | ↓  |    |    |    |    |    | ↓  |    |    |    |    |    |   |
|                     | Brighter   | GS61        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ↓          | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Green      | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 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  | 0  | 1  | 0  | 1  | 1  | 1  | 1 |
|                     | ↓          | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1 |
|                     | Blue       | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 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, VCC=+3.3V

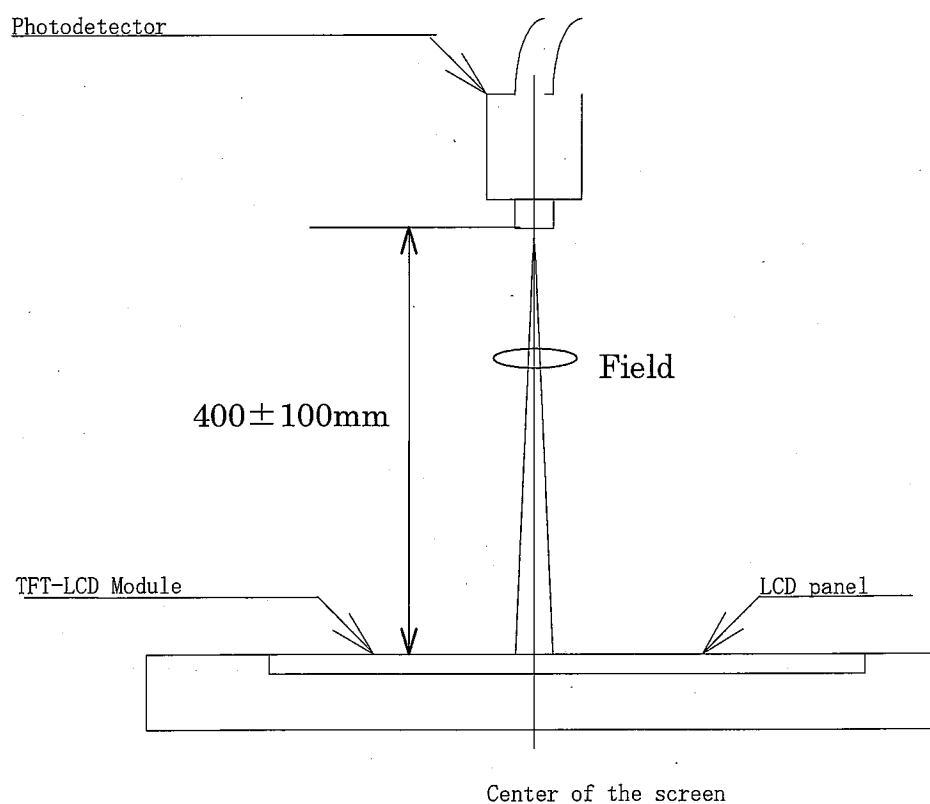
| Parameter           | Symbol             | Condition               | Min          | Typ    | Max   | Unit              | Remarks      |
|---------------------|--------------------|-------------------------|--------------|--------|-------|-------------------|--------------|
| Viewing angle range | $\Delta \theta 11$ | $CR \geq 5$             | 60           | 65     | —     | ° (degree)        | 【Note 9-1,4】 |
|                     | $\Delta \theta 12$ |                         | 50           | 55     | —     | ° (degree)        |              |
|                     | $\Delta \theta 2$  |                         | 60           | 65     | —     | ° (degree)        |              |
| Contrast ratio      | CRmax              | Optimal                 | 100          | —      | —     |                   | 【Note 9-2,4】 |
| Response time       | Rise<br>$\tau r$   | $\theta = 0^\circ$      | —            | 30     | 60    | ms                | 【Note 9-3,4】 |
|                     | Fall<br>$\tau d$   |                         | —            | 50     | 100   | ms                |              |
| Luminance           | Y                  | IL=5.5mA <sub>rms</sub> | 285          | 380    | —     | cd/m <sup>2</sup> | 【Note 9-5】   |
| White chromaticity  | x                  | IL=5.5mA <sub>rms</sub> | 0.263        | 0.313  | 0.363 |                   | 【Note 9-5】   |
|                     | y                  |                         | 0.279        | 0.329  | 0.379 |                   |              |
| lamp life time      | +25°C              | -                       | continuation | 20,000 | —     | hour              | 【Note 9-6】   |
|                     | -30°C              | -                       | intermission | 2,000  | —     | times             | 【Note 9-7】   |

DC/AC inverter for external connection shown in following.

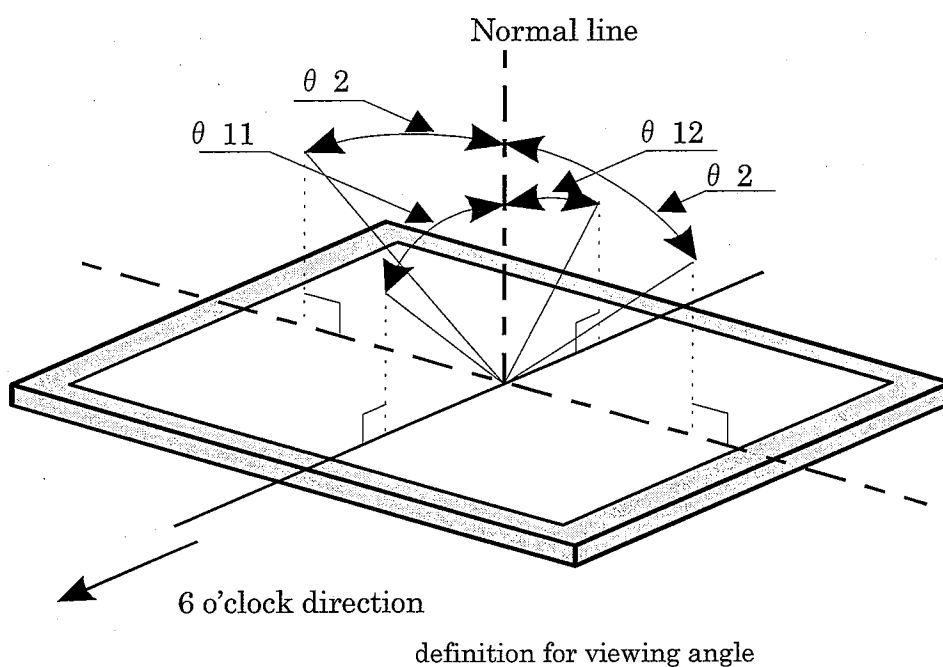
Inverter : HIU-288 [Harison Tosihba Lighting Corp.] (Output capasitor:22pF,frequency:49kHz)

※measuring after 30minutes

Fig.9-1 Optical characteristics measurement method



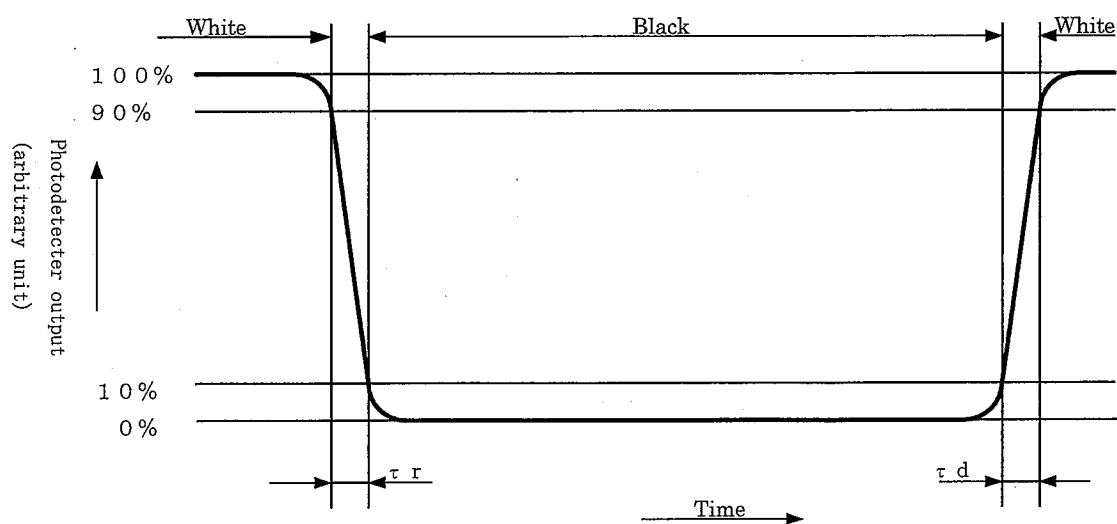
【Note 9-1】 Viewing angle range is defined as follows.



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

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output with LCD being "white"}}{\text{Photo detector output with LCD being "black"}}$$

【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】 Measured on the center area of the panel at a viewing cone  $2^\circ$  (= Filed) by TOPCON luminance meter BM-5A or ELDIM luminance meter EZ Contrast.  
(After 30 minutes operation)

DC/AC inverter driving frequency:( 49 kHz)

【Note 9-5】 Measured on the center area of the panel at a viewing cone  $1^\circ$  (= Filed) by TOPCON luminance meter BM-7.(After 30 minutes operation)

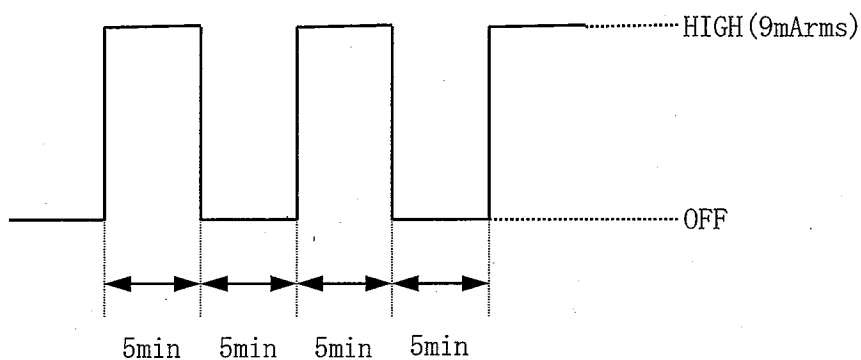
DC/AC inverter driving frequency:( 49 kHz)

【Note 9-6】 Lamp life time is defined as the time when either or occurs in the continuous operation under the condition of lamp current  $IL=5.5\text{mA}_{rms}$  and PWM dimming 80%~5% ( $IL=9.0\text{mA}_{rms}$   $T_a=25^\circ\text{C}$ ).

Brightness not to become under 50% of the original value.

【Note 9-7】 The intermittent cycles is defined as a time when brightness not to become under 50% of the original value under the condition of following cycle.

Ambient temperature:-30°C



**(10) Mechanical characteristics****10-1) External appearance**

Do not exist extreme defects. (See Fig. 1)

**10-2) Panel toughness**

The panel shall not be broken, when 19N is pressed on the center of the panel by a smooth sphere having 15 mm diameter.

Caution: In spite of very soft toughness, if, in the long-term, add pressure on the active area, it is possible to occur the functional damage.

**10-3) Input/output connector performance**

I/O connector of backlight driving circuit 【JST】

Lump connector

| Symbol     | Used Connector   | Corresponding connector             |
|------------|------------------|-------------------------------------|
| CN<br>A, B | BHR-02(8.0)VS-1N | SM02(8.0)B-BHS-1N(assembled on PWB) |
|            |                  | SM02(8.0)B-BHS-TB(assembled on PWB) |
|            |                  | BHMR-03V (interconnector)           |

**(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) Handling instructions****12-1) Mounting of module**

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 M2.6 tapping screw fastening torque is 0.3 through 0.5N·m is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.

Don't reach the pressure of touch-switches of the set side to a module directly, because images may be disturbed.

Please power off the module when you connect the input/output connector.

Please connect the metallic shielding cases of the module and the ground pattern of the inverter circuit surely. If that connection is not perfect, there may be a possibility that the following problems happen.

- The noise from the backlight unit will increase.
- The output from inverter circuit will be unstable. Then, there may be a possibility that some problems happen.
- In some cases, a part of module will heat.
- Please taking care to pull back-light's cable, when you connect the back-light cable's connector.

## 12-2) Precautions in mounting

Polarizer which is made of soft material and susceptible to flaw must be handled carefully.

Protective film (Laminator) is applied on the surface to protect it against scratches and dirties. It is recommended to peel off the laminator immediately before the use, taking care of static electricity.

Precautions in peeling off the laminator

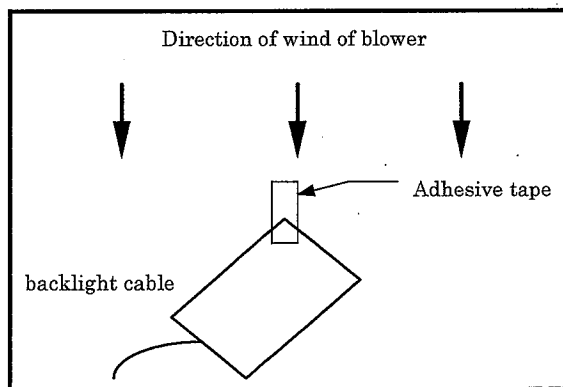
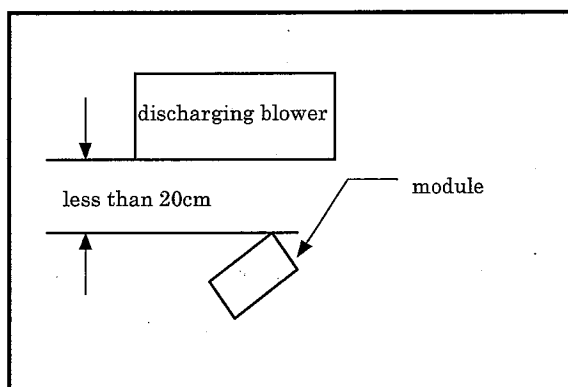
### A) Working environment

When the laminator is peeled off, static electricity may cause dust to stick to the polarizer surface. To avoid this, the following working environment is desirable.

- a) Floor: Conductive treatment of  $1\text{M}\Omega$  or more on the tile  
(conductive mat or conductive paint on the tile)
- b) Clean room free from dust and with an adhesive mat on the doorway
- c) Advisable humidity: 50%~70%      Advisable temperature: 15°C~27°C
- d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

### B) Working procedures

- a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm.
- b) Attach adhesive tape to the laminator part near discharging blower so as to protect polarizer against flaw.
- c) Peel off laminator, pulling adhesive tape slowly to your side taking 5 or more second.
- d) On peeling off the laminator, pass the module to the next work process to prevent the module to get dust.
- e) Method of removing dust from polarizer
  - Blow off dust with N<sub>2</sub> blower for which static electricity preventive measure has been taken.
  - Since polarizer is vulnerable, wiping should be avoided.



But when the panel has stain or grease, we recommend to use adhesive tape to softly remove them from the panel.

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. Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots. TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Handle with care. Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

**12-3)Precautions in adjusting module**

Adjusting volumes on the rear face of the module 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.

**12-4)Caution of product design**

The LCD module shall be protected against water salt-water by the waterproof cover.

Please take measures to interferential radiation from module, to do not interfere surrounding appliances.

**12-5)Others**

Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours; liquid crystal is deteriorated by ultraviolet rays. Store the module at a temperature near the room temperature. At lower than the rated storage temperature, liquid crystal solidifies, causing the panel to be damaged. At higher than the rated storage temperature, liquid crystal turns into isotropic liquid and may not recover. The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around. If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is injurious, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap. Observe all other precautionary requirements in handling general electronic components.

**(13)Packing form (shown in Fig.5.)**

|                                                   |                                  |
|---------------------------------------------------|----------------------------------|
| Piling number of cartons                          | : MAX 10                         |
| Package quantity in one carton                    | : 20 pcs                         |
| Carton size                                       | : 388 (W) × 293 (H) × 190 (D) mm |
| Total mass of one carton filled with full modules | : MAX 5kg                        |
| Conditions for storage.                           |                                  |

**Environment**

|                         |                                                                                                                                                                                                                                     |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①Temperature            | : 0~40℃                                                                                                                                                                                                                             |
| ②Humidity               | : 60%RH or less (at 40℃)<br>No dew condensation at low temperature and high humidity.                                                                                                                                               |
| ③Atmosphere             | : Harmful gas, such as acid or alkali which bites electronic components and/or wires, must not be detected.                                                                                                                         |
| ④Period                 | : about 3 months                                                                                                                                                                                                                    |
| ⑤Opening 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. |

**(14)Reliability test**

Reliability test conditions for the TFT-LCD module are shown in Table 14.

**(15)Others**

Adjusting volume have been set optimally before shipment, so do not change any adjusted value.

If adjusted value is changed, the specification may not be satisfied.

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

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

**15-1)Indication of lot number**

①Attached location of the label : See Fig. 1

②Indicated contents of the

|             |   |   |   |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|---|---|
| LQ050Q5DR01 | R | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
|-------------|---|---|---|---|---|---|---|---|---|

model No.

lot No.

contents of lot No.

the 1st figure ·· production year ( ex. 2001 : 1 )

the 2nd figure ·· production month 1,2,3,·····,9,X,Y,Z

the 3rd~8th figure ·· serial No. 000001~

the 9th figure ·· revision marks A,B,C··

**Reliability Test Conditions for TFT-LCD Module**

Table 14

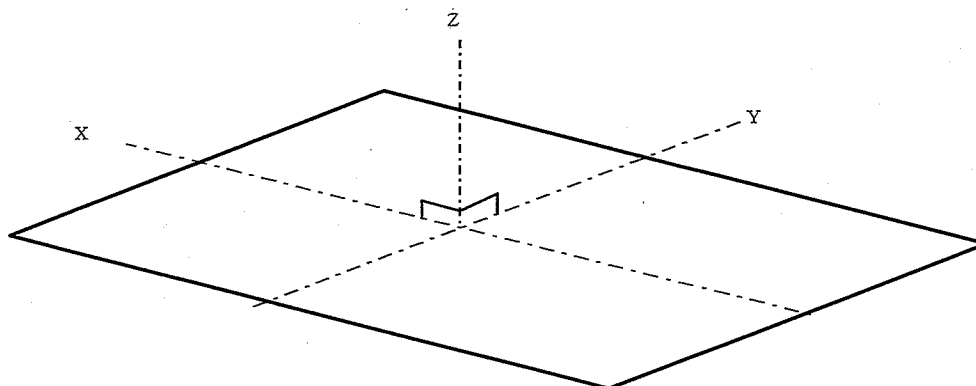
Remark) Temperature condition is based on operating temperature conditions on (5)-Table 5-1.

| No. | Test items                                        | Test conditions                                                                                                                                                                                                                        |                           |
|-----|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1   | High temperature storage test                     | Ta= +95℃                                                                                                                                                                                                                               | 240h                      |
| 2   | Low temperature storage test                      | Ta= -40℃                                                                                                                                                                                                                               | 240h                      |
| 3   | High temperature and high humidity operating test | Tp= +60℃ , 95%RH                                                                                                                                                                                                                       | 240h                      |
| 4   | High temperature operating test                   | Tp= +85℃                                                                                                                                                                                                                               | 240h                      |
| 5   | Low temperature operating test                    | Tp= -30℃                                                                                                                                                                                                                               | 240h                      |
| 6   | Electro static discharge test                     | ±200V · 200pF(0Ω)                                                                                                                                                                                                                      | 1 time for each terminals |
| 7   | Shock test                                        | 980m/s <sup>2</sup> · 6ms, ±X ; ±Y ; ±Z 3 times for each direction<br>(JIS C0041, A-7 Condition C)                                                                                                                                     |                           |
| 8   | Vibration test                                    | Frequency range : 8~33.3Hz<br>Stroke : 1.3mm<br>Sweep : 33.3Hz~400Hz<br>Acceleration : 28.4m/s <sup>2</sup><br>Cycle : 15 minutes<br>X,Z 2 hours for each directions, 4 hours for Y direction<br>(total 8 hours) 【caution】 (JIS D1601) |                           |
| 9   | Heat shock test                                   | Ta= -40℃~+95℃ / 200 cycles<br>(0.5h) (0.5h)                                                                                                                                                                                            |                           |

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

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

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





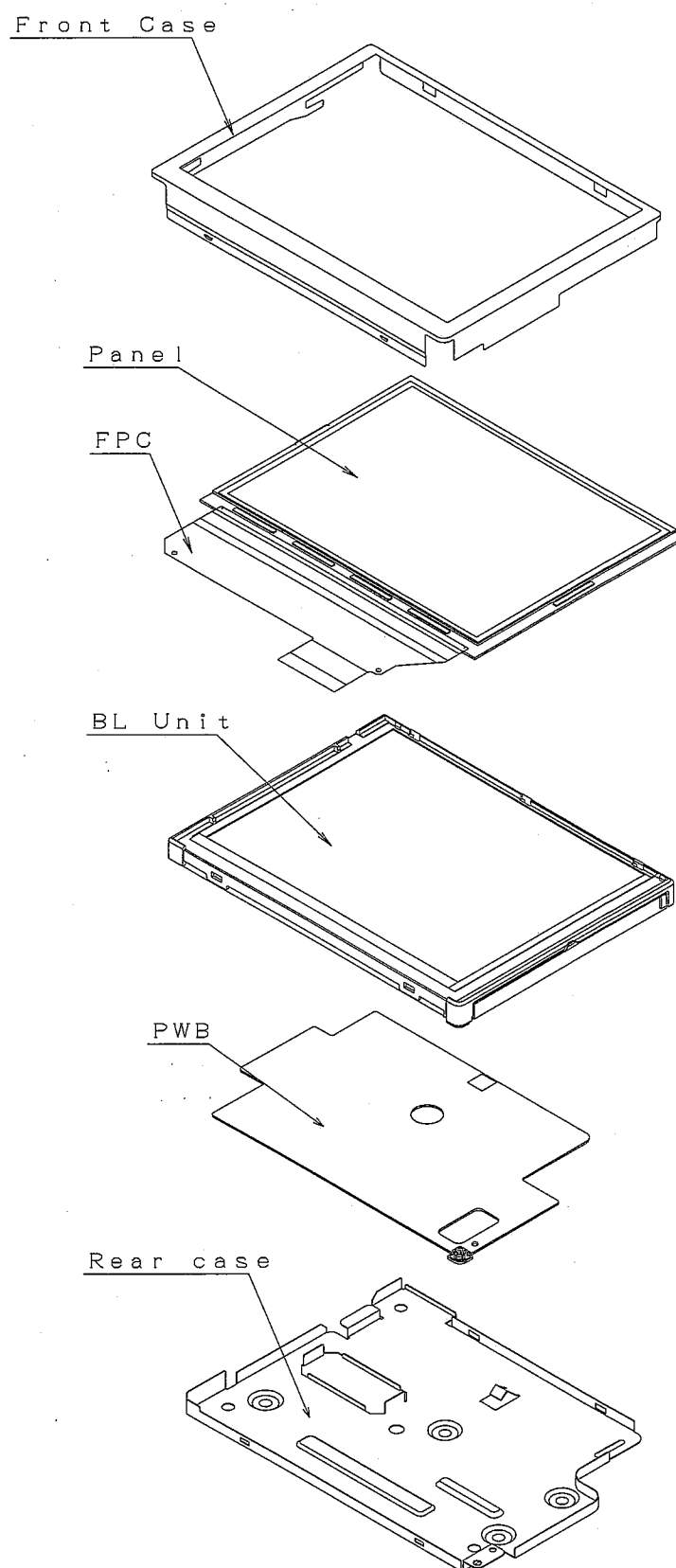


Fig.2. Structure of the module

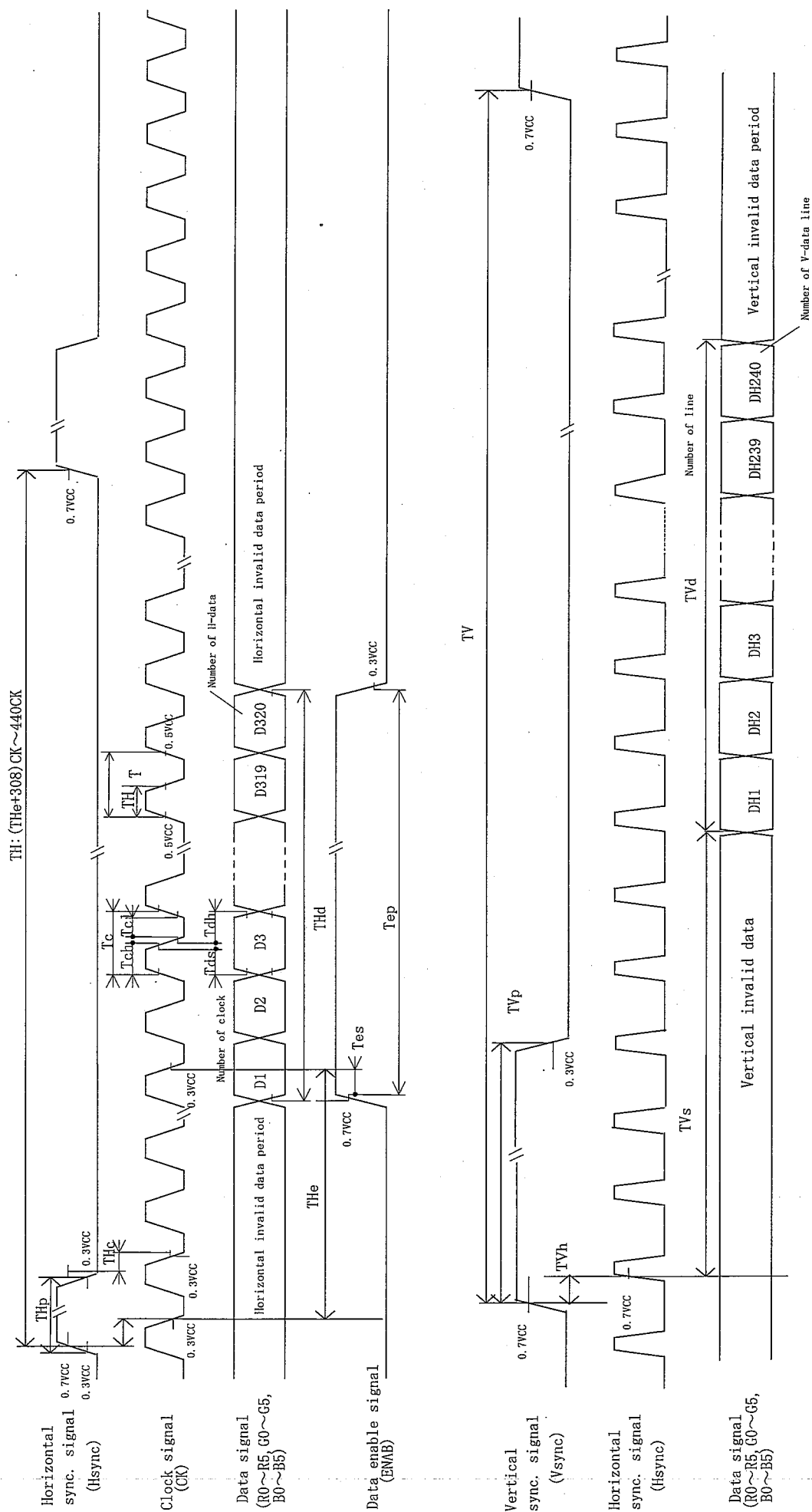
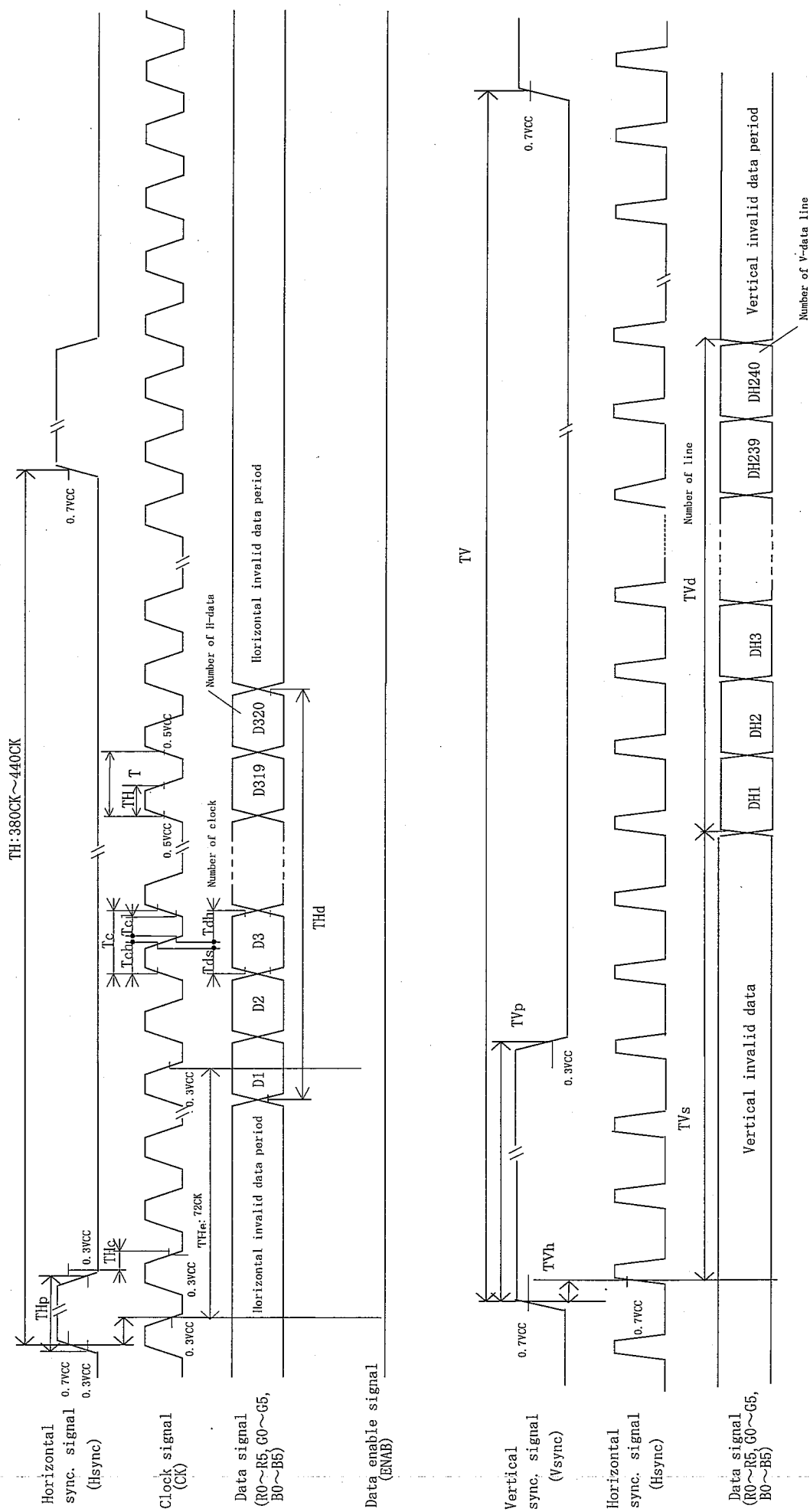


Fig3-A Input signal waveform



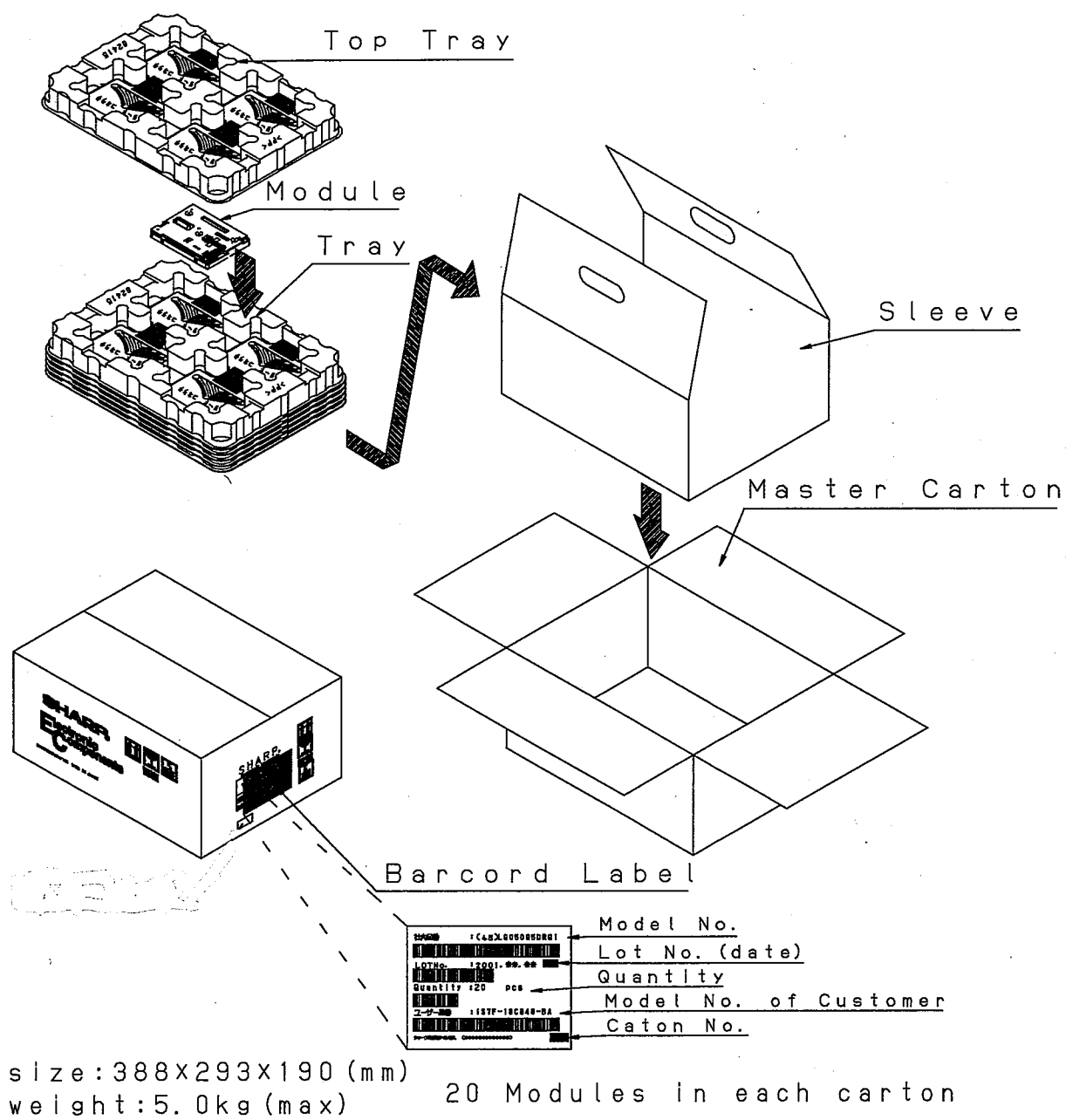


Fig.4.Packing form

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