

|          |                  |
|----------|------------------|
| No.      | <b>LD-24457A</b> |
| DATE     | Apr. 27. 2012    |
| REVISION |                  |

TECHNICAL LITERATURE

FOR

TFT - LCD module

**These parts have corresponded with the RoHS directive.**

MODEL No. **LQ090Y3DG01**

The technical literature is subject to change without notice.  
So, please contact SHARP or its representative before designing  
your product based on this literature.

DEPARTMENT DEPT. I  
DISPLAY DEVICE DIVISION II  
DISPLAY DEVICE DIVISION GROUP  
SHARP CORPORATION

### RECORDS OF REVISION

LQ090Y3DG05

[illegible]

These technical literature sheets are the proprietary product of SHARP CORPORATION("SHARP") and include materials protected under copyright of SHARP. Do not reproduce or cause any third party to reproduce them in any form or by any means, electronic or mechanical, for any purpose, in whole or in part, without the express written permission of SHARP.

In case of using the device for applications such as control and safety equipment for transportation(aircraft, trains, automobiles, etc. ), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment(trunk lines), nuclear power control equipment and medical or other equipment for life support.

SHARP assumes no responsibility for any damage resulting from the use of the device, which does not comply with the instructions, and the precautions specified in these technical literature sheets.

Contact and consult with a SHARP sales representative for any questions about this device.



## Table of contents

|                                                                           |    |
|---------------------------------------------------------------------------|----|
| 1. Application.....                                                       | 3  |
| 2. Overview .....                                                         | 3  |
| 3. Mechanical Specifications .....                                        | 3  |
| 4. Input Terminals .....                                                  | 4  |
| 4-1. TFT-LCD panel driving .....                                          | 4  |
| 4-2 Interface block diagram .....                                         | 5  |
| 5. Absolute Maximum Ratings.....                                          | 6  |
| 6. Electrical Characteristics .....                                       | 7  |
| 6-1.TFT-LCD panel driving.....                                            | 7  |
| 6-2.Backlight driving .....                                               | 9  |
| 7. Timing Characteristics of Input Signals.....                           | 10 |
| 7-1. Timing characteristics.....                                          | 10 |
| 7-2. Input data signals and display position on the screen .....          | 10 |
| 8. Input Signals, Basic Display Colors and Gray Scale of Each Color ..... | 11 |
| 9. Optical Characteristics .....                                          | 12 |
| 10. Display Quality .....                                                 | 13 |
| 11. Handling Precautions .....                                            | 14 |
| 12. Packing form .....                                                    | 15 |
| 13. RoHS Directive .....                                                  | 15 |
| Fig.1 Outline Dimensions .....                                            | 16 |
| Fig.2 Packing form.....                                                   | 17 |

## 1. Application

This technical literature applies to a color TFT-LCD module, LQ090Y3DG01

## 2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, and a backlight unit.

Graphics and texts can be displayed on a 800×RGB×480 dots panel with 16,777,216 colors by using 24bit digital signal interface (RGB×8bit) and DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

In this TFT-LCD panel, low reflection / color filters of excellent color performance and backlights of high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

Optimum viewing direction is 6 o'clock.

Backlight-driving DC/DC converter is not built in this module.

## 3. Mechanical Specifications

| Parameter           | Specifications                 | Unit  |
|---------------------|--------------------------------|-------|
| Display size        | 22.9 (9.0") Diagonal           | cm    |
| Active area         | 198.0 (H)×111.7 (V)            | mm    |
| Pixel format        | 800 (H)×480 (V)                | pixel |
|                     | (1 pixel = R+G+B dots)         |       |
| Pixel pitch         | 0.2475 (H)×0.2327 (V)          | mm    |
| Pixel configuration | R,G,B Vertical stripe          |       |
| Display mode        | Normally white                 |       |
| Surface treatment   | Anti Glare and hard-coating 3H |       |

| Parameter                           |        | Min.  | Typ.  | Max.  | Unit | Remark   |
|-------------------------------------|--------|-------|-------|-------|------|----------|
| Unit outline dimensions<br>[Note 1] | Width  | 210.6 | 211.1 | 211.6 | mm   | [Note 1] |
|                                     | Height | 127.9 | 128.4 | 128.9 | mm   |          |
|                                     | Depth  | —     | 6.6   | 7.1   | mm   |          |
| Mass                                |        | —     | 255   | —     | g    |          |

[Note 1] Outline dimensions is shown in Fig.1,2

## 4. Input Terminals

## 4-1. TFT-LCD panel driving

Using connector: 089H50-000000-G2-R (Starconn)

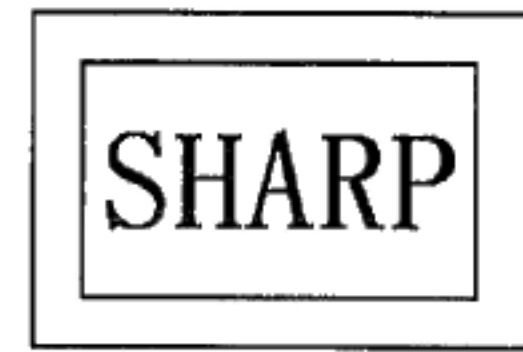
| Pin No. | Symbol  | Function                                   | Remark      |
|---------|---------|--------------------------------------------|-------------|
| 1       | GND     | Ground                                     |             |
| 2       | GND     | Ground                                     |             |
| 3       | VDD     | LCD Power Supply                           |             |
| 4       | VDD     | LCD Power Supply                           |             |
| 5       | U/D     | Vertical display mode select signal        | [Note 4-3]  |
| 6       | L/R     | Horizontal display mode select signal      | [Note 4-3]  |
| 7       | GND     | Ground                                     |             |
| 8       | R0      | Red data input (LSB)                       | [Note 4-1]  |
| 9       | R1      | Red data input                             | [Note 4-1]  |
| 10      | R2      | Red data input                             |             |
| 11      | R3      | Red data input                             |             |
| 12      | GND     | Ground                                     |             |
| 13      | R4      | Red data input                             |             |
| 14      | R5      | Red data input                             |             |
| 15      | GND     | Ground                                     |             |
| 16      | R6      | Red data input                             |             |
| 17      | R7      | Red data input (MSB)                       |             |
| 18      | GND     | Ground                                     |             |
| 19      | G0      | Green data input (LSB)                     | [Note 4-1]  |
| 20      | G1      | Green data input                           | [Note 4-1]  |
| 21      | G2      | Green data input                           |             |
| 22      | G3      | Green data input                           |             |
| 23      | GND     | Ground                                     |             |
| 24      | G4      | Green Data input                           |             |
| 25      | G5      | Green data input                           |             |
| 26      | GND     | Ground                                     |             |
| 27      | G6      | Green data input                           |             |
| 28      | G7      | Green data input (MSB)                     |             |
| 29      | GND     | Ground                                     |             |
| 30      | B0      | Blue data input (LSB)                      | [Note 4-1]  |
| 31      | B1      | Blue data input                            | [Note 4-1]  |
| 32      | B2      | Blue data input                            |             |
| 33      | B3      | Blue data input                            |             |
| 34      | GND     | Ground                                     |             |
| 35      | B4      | Blue data input                            |             |
| 36      | B5      | Blue data input                            |             |
| 37      | GND     | Ground                                     |             |
| 38      | B6      | Blue data input                            |             |
| 39      | B7      | Blue data input (MSB)                      |             |
| 40      | GND     | Ground                                     |             |
| 41      | DCLK    | Clock signal for sampling each data signal | [Note 4-2]  |
| 42      | GND     | Ground                                     |             |
| 43      | DE      | Data Enable Signal                         |             |
| 44      | TEST    | Please fix "Low".                          |             |
| 45      | GND     | Ground                                     |             |
| 46      | GND     | Ground                                     |             |
| 47      | LED_PWM | LED PWM Signal                             |             |
| 48      | LED_EN  | LED Enable Signal                          | High Enable |
| 49      | VLED    | LED Power                                  |             |
| 50      | VLED    | LED Power                                  |             |

[Note 4-1] When input 18 bits RGB data, this terminals must be "Low" level.

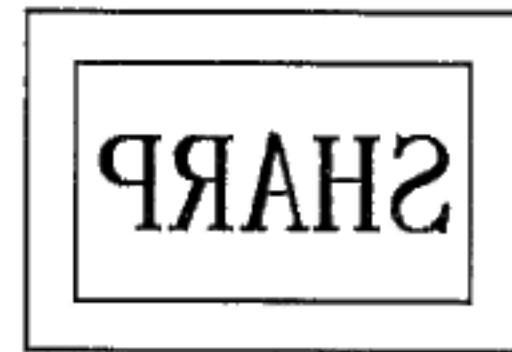


[Note 4-2] Data shall be latch at falling edgh of DCLK.

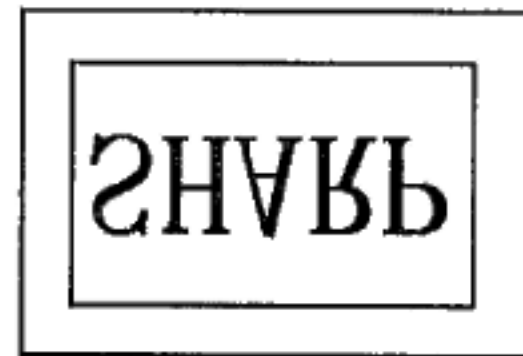
[Note 4-3]



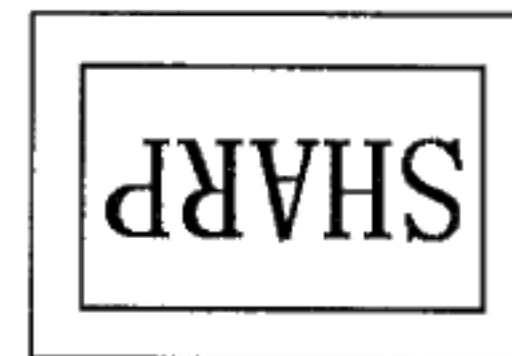
R/L=High, U/D=Low



R/L=Low, U/D=Low

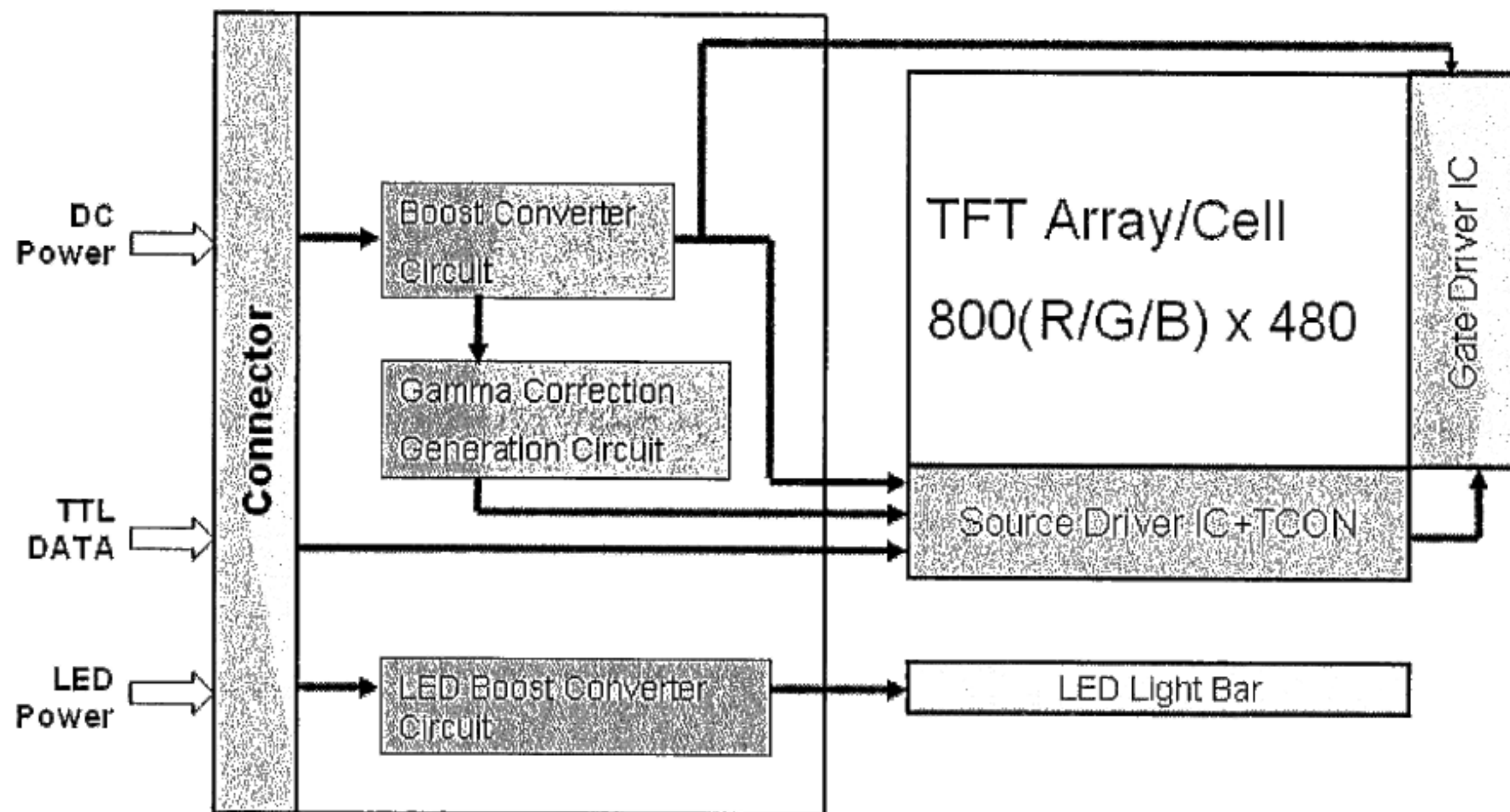


R/L=High, U/D=High



R/L=Low, U/D=Low

4-2 Interface block diagram



## 5. Absolute Maximum Ratings

| Parameter             | Symbol | Condition | Ratings |      | Unit | Remark       |
|-----------------------|--------|-----------|---------|------|------|--------------|
|                       |        |           | Min.    | Max. |      |              |
| Input voltage         | VDD    |           | -0.3    | 4.0  | V    | [Note 3]     |
| LED reverse voltage   | VLED   |           | -0.3    | 22   | V    | [Note 3]     |
| Input voltage         | VI1    | Ta=25°C   | -0.3    | 4.0  | V    | [Note 3,4]   |
|                       | VI2    | Ta=25°C   | -0.3    | 6.0  | V    | [Note 3,5]   |
| Storage temperature   | Tstg   | -         | -30     | +80  | °C   | [Note 1,2,6] |
| Operating temperature | Topa   | -         | -20     | +75  | °C   | [Note 1,2,6] |

[Note 1] Humidity: 90%RH Max. (at Ta=<40°C)

Maximum wet-bulb temperature at 39°C or less (at Ta>40 °C)

Dew condensation must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note 2] The operating temperature guarantees only operation of the circuit.

For contrast, response time and other factors related to display quality, judgment is done using the ambient temperature Ta=+25°C.

[Note 3] Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

[Note 4] R0~R7, G0~G7, B0~B7, DCLK, DE, U/D, L/R, Do not use over VDD+0.3V.

[Note 5] LED\_PWM, LED\_EN, Do not use over VDD+0.3V.

[Note 6] Permanent damage may occur to the LCD module if beyond this specification.

Functional operation and LCD storage should be restricted to the conditions described under normal temperature (LCD outside).



## 6. Electrical Characteristics

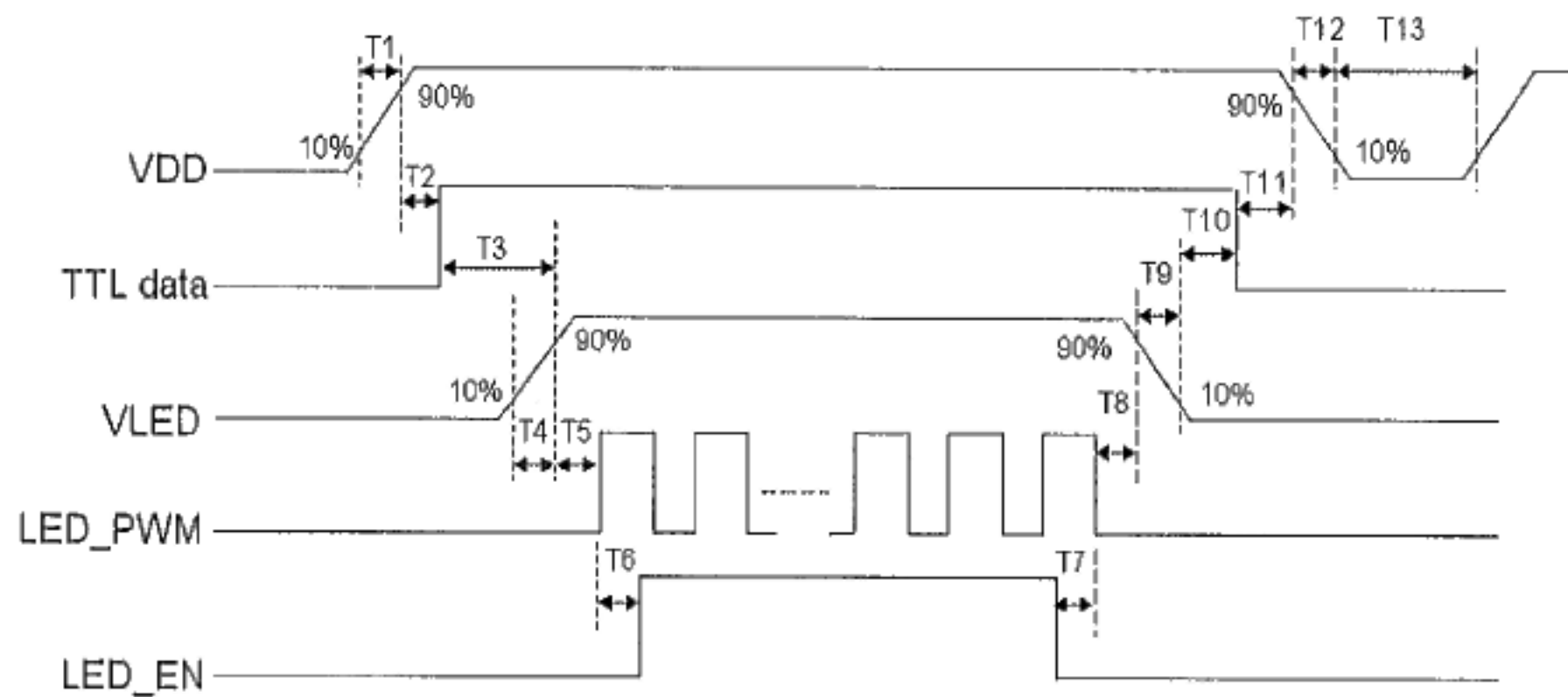
## 6-1.TFT-LCD panel driving

Ta=25°C

| Parameter                       | Symbol     | Condition                   | Min.        | Typ. | Max.        | Unit              | Remark        |
|---------------------------------|------------|-----------------------------|-------------|------|-------------|-------------------|---------------|
| Supply voltage                  | $V_{DD}$   |                             | 3.0         | 3.3  | 3.6         | V                 | [Note 2]      |
| Input voltage range             | $I_{DD}$   | $V_{DD}=3.3V$               | —           | 100  | 210         | mA                | Black pattern |
| Power consumption               | $P_{DD}$   |                             | —           | —    | 0.7         | W                 | 60Hz          |
| Rush current                    | $I_{rush}$ |                             | —           | —    | 1.5         | A                 | [Note 3]      |
| Permissive input ripple voltage | $V_{RP}$   |                             | —           | —    | 100         | mV <sub>P-P</sub> | $V_{DD}=3.3V$ |
| Input voltage range             | $V_{IH}$   | “High”                      | $0.7V_{DD}$ | —    | $V_{DD}$    | V                 | [Note 1]      |
| Input voltage range             | $V_{IL}$   | “Low”                       | 0           | —    | $0.3V_{DD}$ | V                 |               |
| Input leak current              | $I_{OH}$   | $V_I=2.4V$<br>$V_{DD}=3.3V$ | —           | —    | 400         | $\mu A$           | [Note 4]      |
| Input leak current              | $I_{OL}$   | $V_{I2}=0V$                 | -10         | —    | +10         | $\mu A$           |               |

[Note 1] R0~R7、G0~G7、B0~B7、DE、DCLK、L/R、U/D

[Note 2]

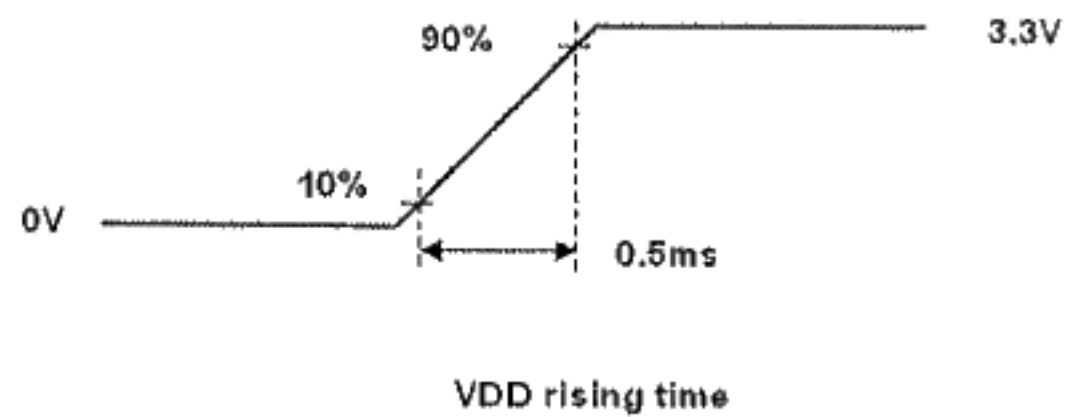


| Symbol | Min. | Typ. | Max. | Unit |
|--------|------|------|------|------|
| T1     | 0.5  | -    | 10   | ms   |
| T2     | 30   | -    | 90   | ms   |
| T3     | 200  | -    | -    | ms   |
| T4     | 0.5  | -    | -    | ms   |
| T5     | 10   | -    | -    | ms   |
| T6     | 10   | -    | -    | ms   |
| T7     | 0    | -    | -    | ms   |
| T8     | 10   | -    | -    | ms   |
| T9     | -    | 10   | 30   | ms   |
| T10    | 200  | -    | -    | ms   |
| T11    | 0    | -    | 50   | ms   |
| T12    | -    | 10   | 30   | ms   |
| T13    | 500  | -    | -    | ms   |

\*TTL\_DATA: R0~R7、G0~G7、B0~B7、DE、DCLK、L/R、U/D

- This LCD is driven only by DE signal. Hsync/Vsync does not need to input.
- As for the power sequence for backlight, it is recommended to apply above mentioned input timing. If the backlight is lit on and off at a timing other than shown above, displaying image may get disturbed.

[Note 3] LCD rush current measurement condition



[Note 4] VDD power dip condition

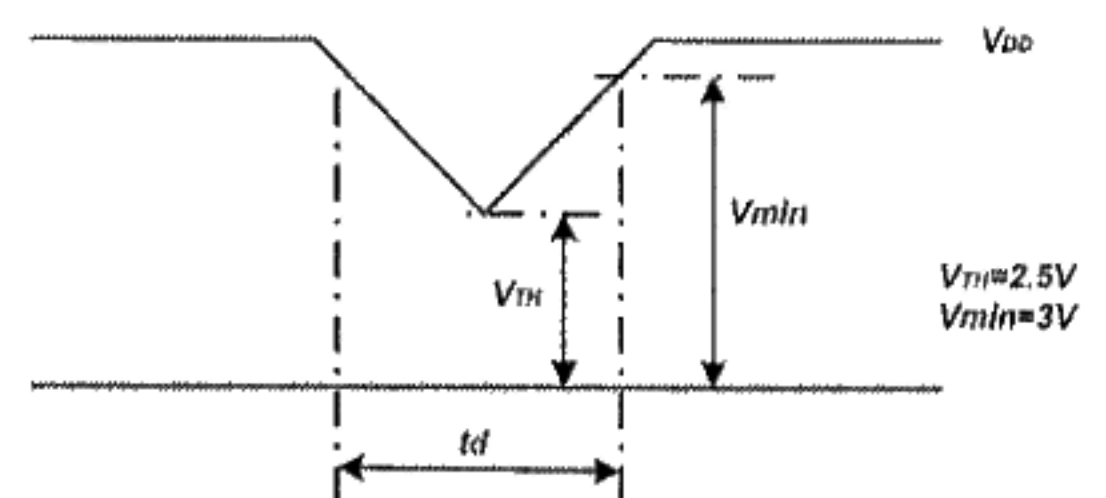
1)  $V_{th} < V_{CC} \leq V_{min}$

$t_d \leq 10ms$

Under above condition, the display image should return to an appropriate figure after Vcc voltage recovers.

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

Vcc-dip conditions should also follow the  
On-off conditions for supply voltage



## 6-2.Backlight driving

It is usually required to measure under the following condition.

$T_a=25^{\circ}\text{C}\pm 2^{\circ}\text{C}$

| Parameter                       |      | Symbol       | Min.  | Typ. | Max.  | Unit  | Remarks                    |
|---------------------------------|------|--------------|-------|------|-------|-------|----------------------------|
| Supply voltage                  |      | $V_{DD}$     | 4.5   | 12.0 | 21.0  | V     | [Note2] (see.page 7)       |
| Power consumption               |      | $I_{DD}$     | -     | -    | 2.1   | W     |                            |
| Permissive input ripple voltage |      | $V_{RP\_BL}$ | -     | -    | 200   | mVp-p |                            |
| Input voltage                   | High | $V_{IH\_BL}$ | 3.0   | -    | 5.5   |       | [Note5]                    |
|                                 | Low  | $V_{IL\_BL}$ | 0     | -    | 0.5   | V     |                            |
| Rush current                    |      | $I_{Lrush}$  | -     | -    | 2.0   | A     | [Note8]                    |
| PWM frequency                   |      | $f_{PWM}$    | 100   | -    | 1,000 | Hz    | Ddim $\geq$ 1% [Note6]     |
|                                 |      |              | 100   | -    | 5,000 | Hz    | Ddim $\geq$ 5% [Note6]     |
| Life time                       |      | LT           | 20000 |      | -     | H     | Reference value<br>[Note7] |

[Note 5] LED\_PWM、LED\_EN

[Note 6] PWM

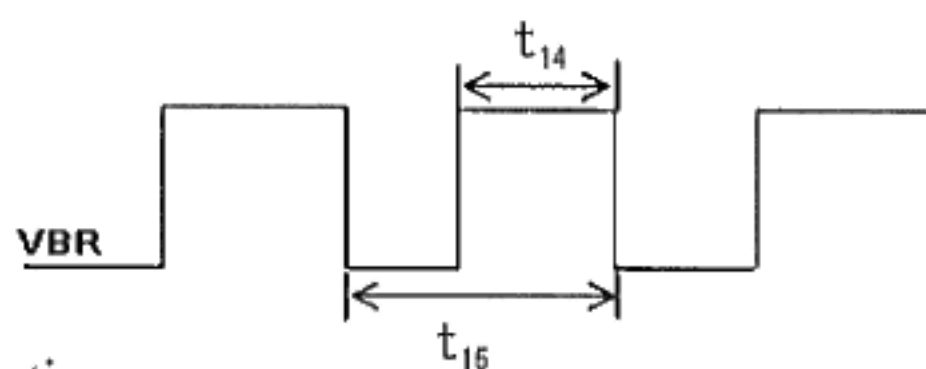
$$f_{PWM} = 1/t_{15}$$

Duty 5% : Min. Luminance

Duty 100% : Max. Luminance

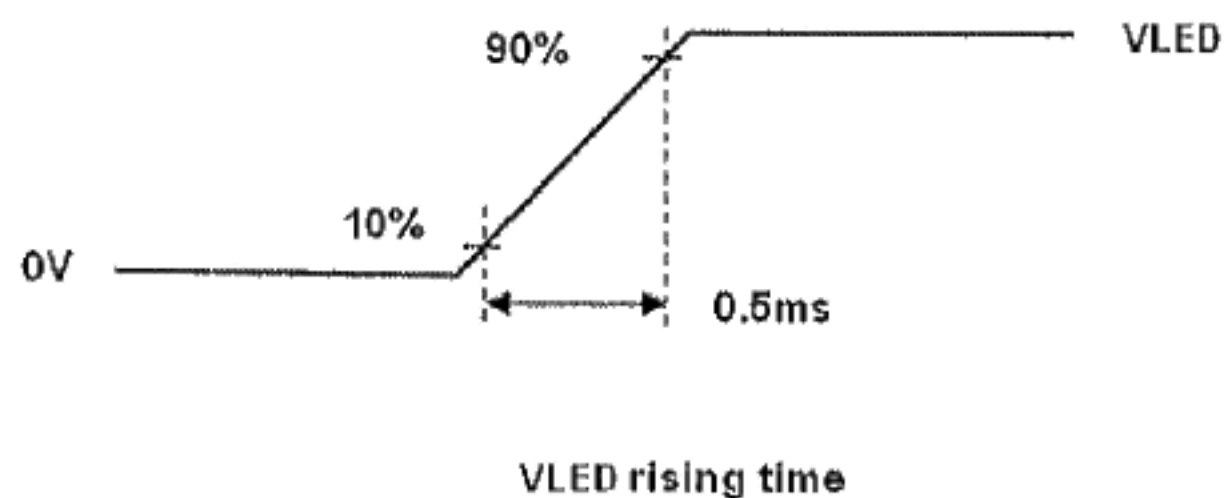
Luminance changes in proportion to the duty ratio.

When the frequency slows, the display fineness might decrease.



[Note 7] Luminance becomes 50% of an initial value. ( $T_a=25^{\circ}\text{C}$ , PWM=100%)

[Note 8] LED rush current measure condition



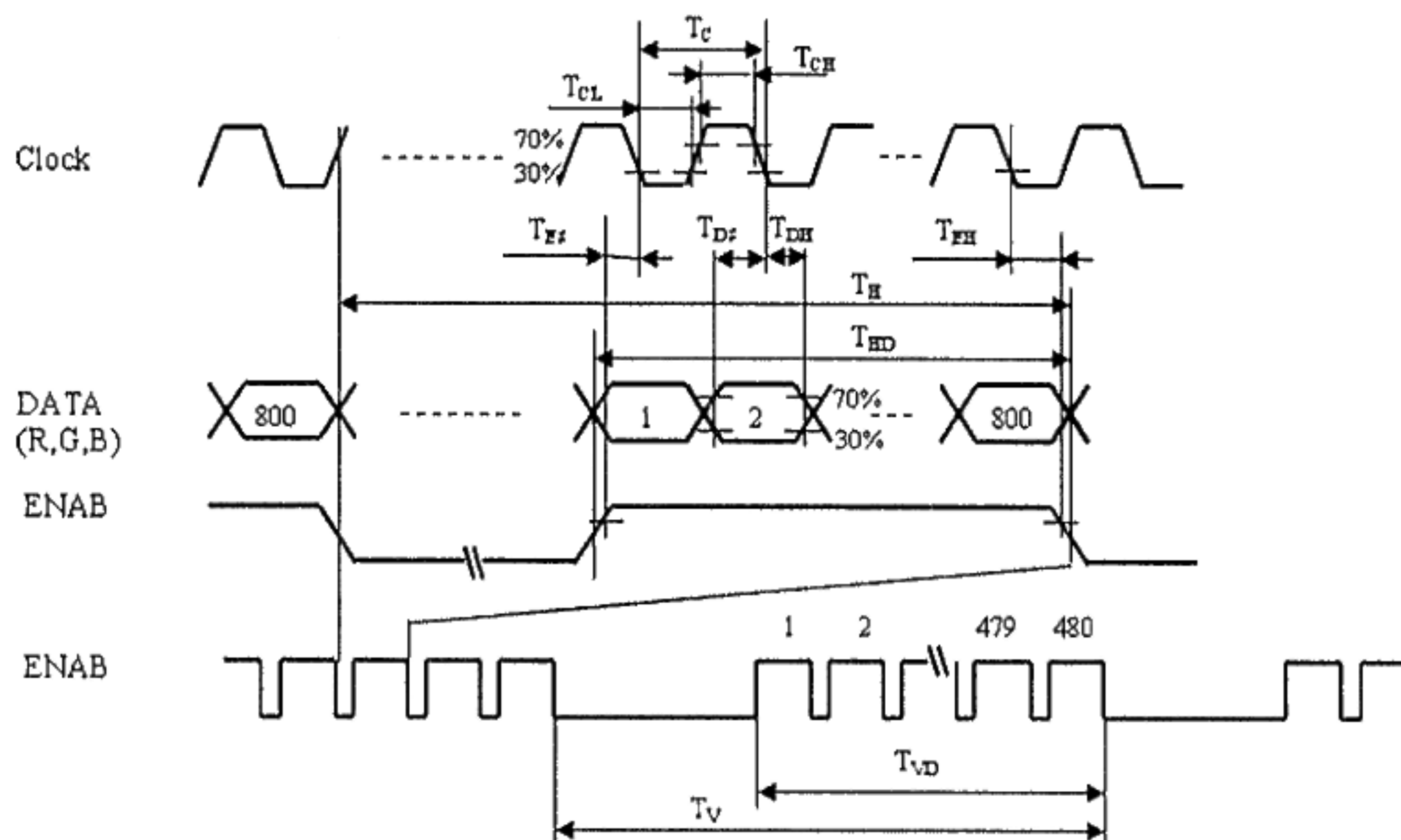


## 7. Timing Characteristics of Input Signals

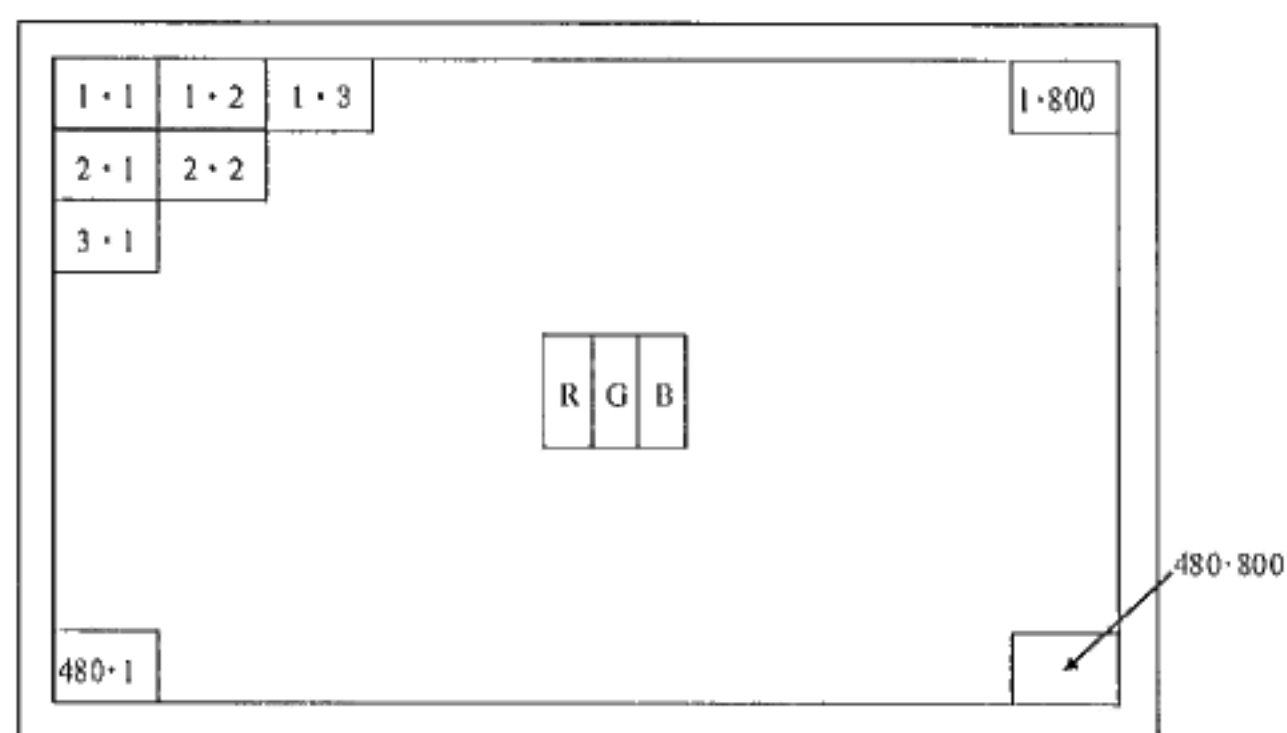
### 7-1. Timing characteristics

| Characteristics |            | Symbol       | Min.     | Typ. | Max. | Unit  | Remark  |
|-----------------|------------|--------------|----------|------|------|-------|---------|
| DOTCLK          | Frequency  | $1/T_C$      | 28.0     | 30.0 | 35.0 | MHz   |         |
|                 | High Width | $T_{CH}$     | 10       | —    | —    | Ns    |         |
|                 | Low Width  | $T_{CL}$     | 10       | —    | —    | Ns    |         |
|                 | Duty ratio | $T_{CH}/T_C$ | 40       | 50   | 60   | %     |         |
| DATA            | Setup Time | $T_{DS}$     | 8        | —    | —    | Ns    |         |
|                 | Hold Time  | $T_{DH}$     | 8        | —    | —    | Ns    |         |
| ENAB            | Horizontal | Period       | $T_H$    | 908  | 928  | Clock |         |
|                 |            | Display Area | $T_{HD}$ | 800  | 800  | Clock |         |
|                 |            | Period       | $T_V$    | 517  | 525  | Line  | [Note1] |
|                 | Vertical   | Display Area | $T_{VP}$ | 480  | 480  | Line  |         |
|                 |            | Setup time   | $T_{ES}$ | 8    | -    | Ns    |         |
|                 |            | Hold time    | $T_{EH}$ | 8    | -    | ns    |         |

[Note1] In case of lower frequency, the deterioration of display quality, flicker etc., may be occurred.



### 7-2. Input data signals and display position on the screen



Display position of input data(V · H)

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

|                     | Colors &<br>Gray scale | Data signal   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |
|---------------------|------------------------|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|
|                     |                        | Gray<br>Scale | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |  |  |  |
|                     | Black                  | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Blue                   | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Green                  | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Cyan                   | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Red                    | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Magenta                | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Yellow                 | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 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  | 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  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | GS1           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Darker                 | GS2           | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |  |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |  |  |  |
|                     | Brighter               | GS253         | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↓                      | GS254         | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Red                    | GS255         | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
| Gray Scale of Green | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | GS1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Darker                 | GS2           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |  |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |  |  |  |
|                     | Brighter               | GS253         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↓                      | GS254         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Green                  | GS255         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
| Gray Scale of Blue  | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | GS1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Darker                 | GS2           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |  |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |  |  |  |
|                     | Brighter               | GS253         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | ↓                      | GS254         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Blue                   | GS255         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |

0 : Low level voltage,      1 : High level voltage.

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16 million-color display can be achieved on the screen.

## 9. Optical Characteristics

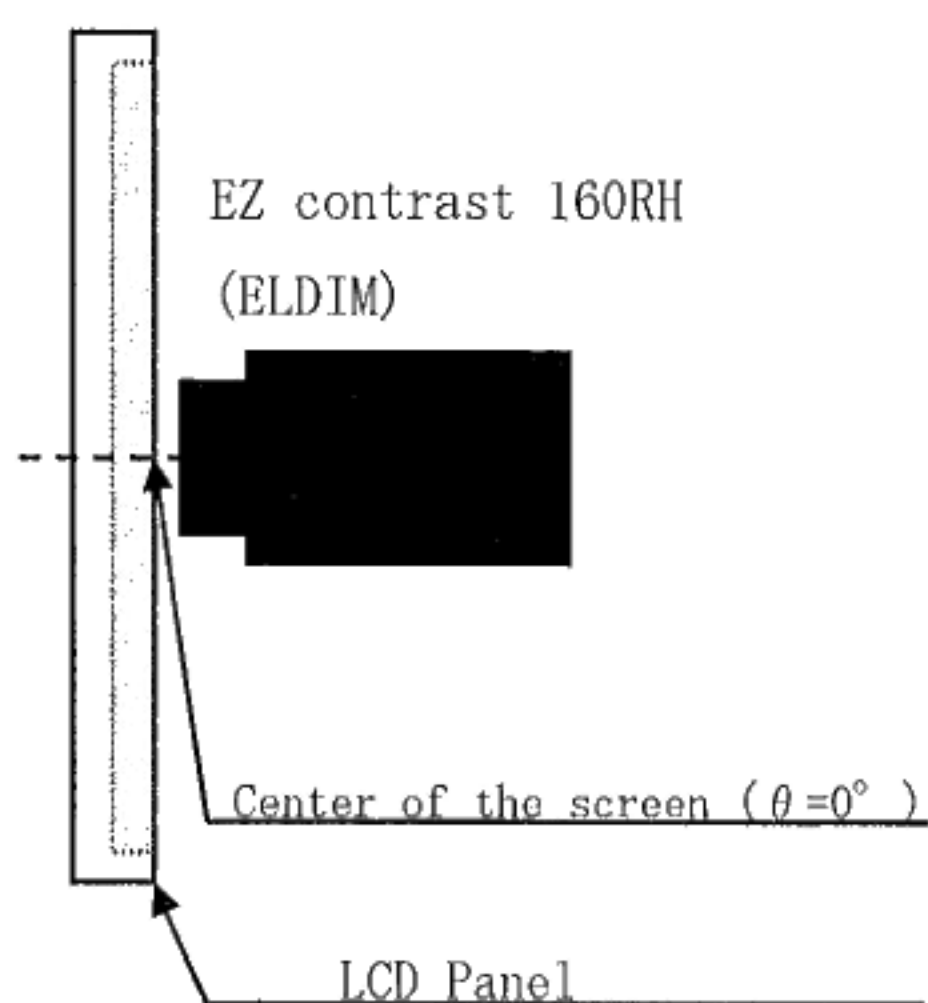
Ta=+25°C, Vcc=+3.3V

| Parameter             |            | Symbol                     | Condition          | Min.  | Typ.  | Max.  | Unit | Remark            |
|-----------------------|------------|----------------------------|--------------------|-------|-------|-------|------|-------------------|
| Viewing angle range   | Horizontal | $\theta_{21}, \theta_{22}$ | CR>10              | 60    | 70    | —     | Deg. | [Note 1,3,6]      |
|                       | Vertical   | $\theta_{11}$              |                    | 40    | 50    | —     | Deg. |                   |
|                       |            | $\theta_{12}$              |                    | 50    | 60    | —     | Deg. |                   |
| Contrast ratio        |            | CR <sub>n</sub>            | $\theta = 0^\circ$ | 400   | 500   | —     |      | [Note 2,4,6]      |
| Response time         |            | $\tau_r + \tau_d$          |                    | —     | 25    | 50    | ms   | [Note 2,5,6]      |
| Chromaticity of white | $x$        |                            |                    | 0.260 | 0.310 | 0.360 |      | [Note 2,6]        |
|                       | $y$        |                            |                    | 0.280 | 0.330 | 0.380 |      |                   |
| Luminance of white    |            | Y <sub>Li</sub>            |                    |       | 200   | 300   | —    | cd/m <sup>2</sup> |

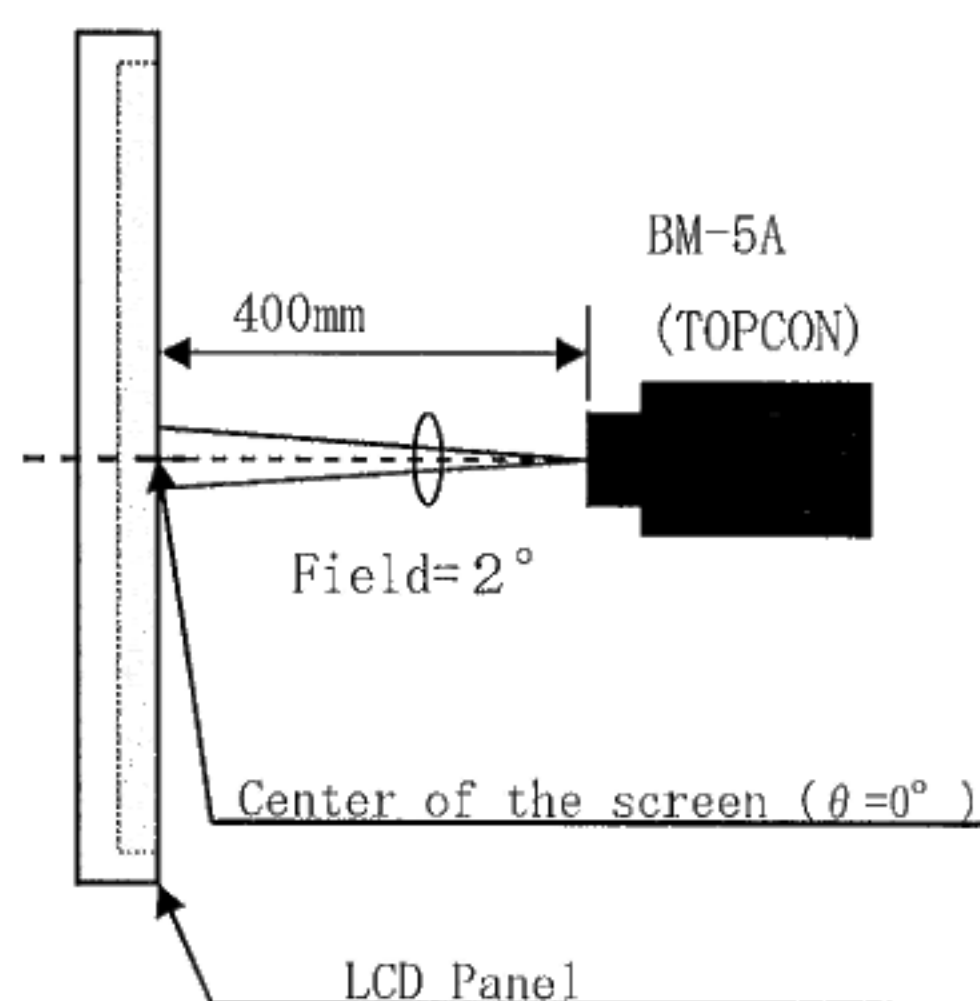
※ The measurement shall be executed 30 minutes after lighting at rating. Condition : Ddim=100%

The optical characteristics shall be measured in a dark room or equivalent.

[Note 1] Measuring Viewing Angle Range

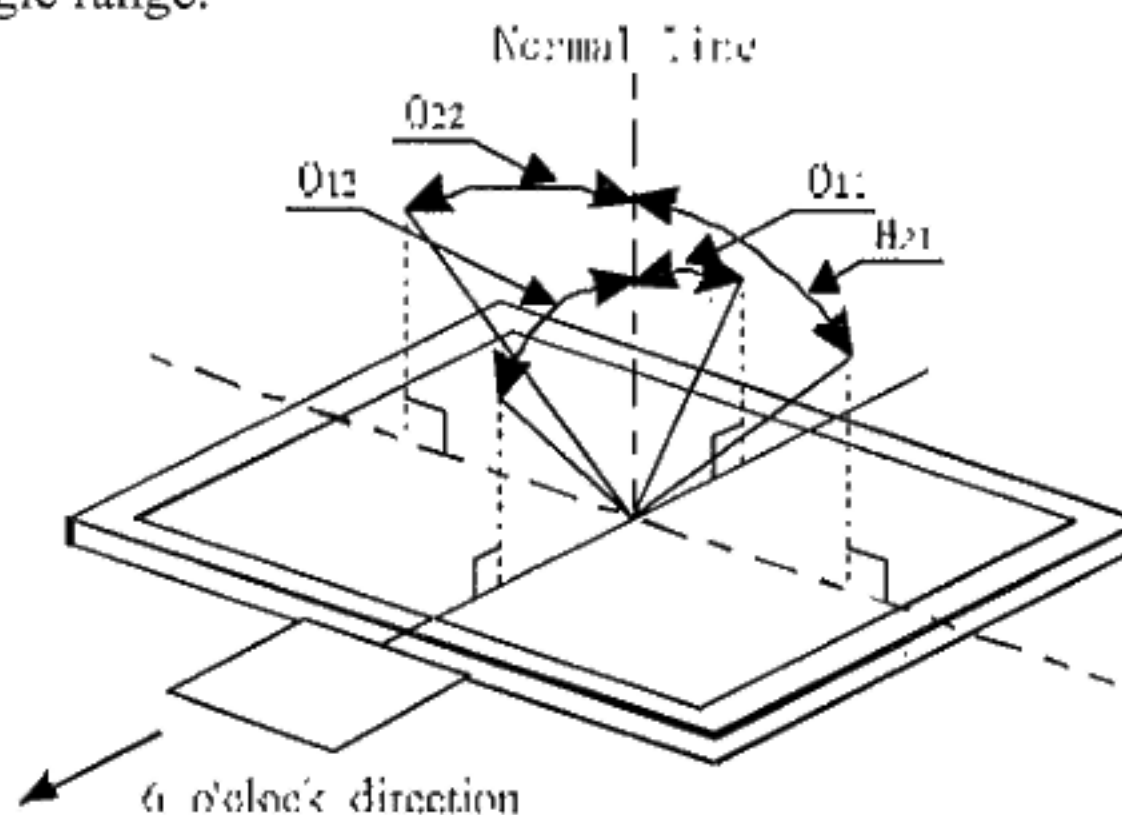


[Note 2] Other Measurements





[Note 3] Definitions of viewing angle range:



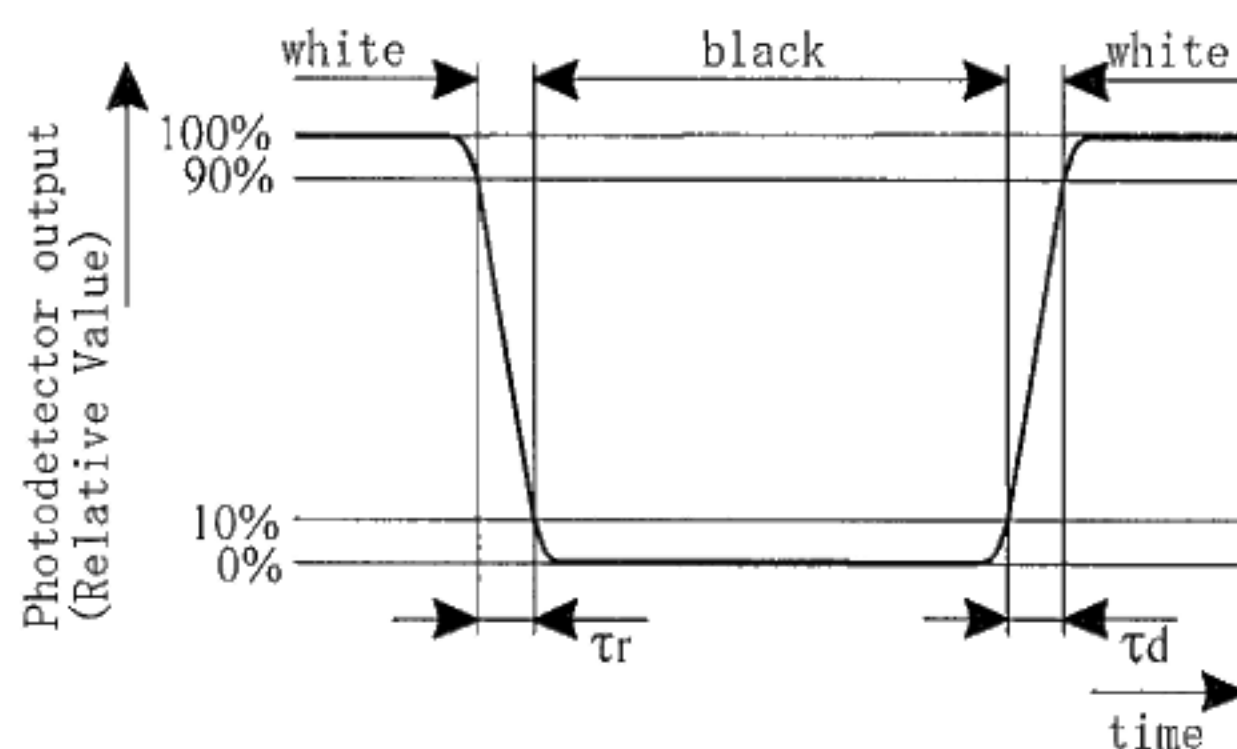
[Note 4] Definition of contrast ratio:

The contrast ratio is defined as the following.

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

[Note 5] 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 6] This shall be measured at center of the screen.

## 10. Display Quality

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

## 11. Handling Precautions

| 【Handling Precautions】   |                                                                                                                                                                                                                                                                                                                    |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)                       | Treat LCD module in dustless surroundings. Metal foreign material stuck to the circuit is possible to cause a short.                                                                                                                                                                                               |
| b)                       | Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.                                                                                                                                                                                                  |
| c)                       | Be careful not to give any physical stress onto the circuit and/or the connector of LCD module when you pull/plug a cable. Physical stress will cause a break or worse connection.                                                                                                                                 |
| d)                       | Since the front polarizer is easily damaged, pay attention not to scratch it.                                                                                                                                                                                                                                      |
| e)                       | Use N2-blower such as an ionized nitrogen has anti-electrostatic when you blow dusts on Polarizer.                                                                                                                                                                                                                 |
| f)                       | Since a long contact with water may cause discoloration or spots, wipe it with absorbent cotton or other soft cloth immediately.                                                                                                                                                                                   |
| g)                       | Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.                                                                                                                              |
| h)                       | Be careful with the edge parts of the module which is made of metal.                                                                                                                                                                                                                                               |
| i)                       | Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.                                                                                                                                                                                                    |
| j)                       | When the panel is broken, don't touch the glass. Although the panel is difficult to be scattered, touching the broken part may hurt your hands.                                                                                                                                                                    |
| k)                       | Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.                                                                                                                                                                  |
| l)                       | Don't touch the circuit and the pattern of the board. If you touch it, the circuit may be broken.                                                                                                                                                                                                                  |
| m)                       | Follow the regulations when LCD module is scrapped. The government you stay may have some regulations about it.                                                                                                                                                                                                    |
| n)                       | Protection film is attached to the module surface to prevent it from being scratched. Peel the film off slowly, just before the use, with strict attention to electrostatic charges. Blow off 'dust' on the polarizer by using an ionized nitrogen.                                                                |
| o)                       | After peel off the protection film, do not attach a lamination etc on the polarizer surface. If reattach a lamination film and strage a long terms,                                                                                                                                                                |
| 【Set-Design Precautions】 |                                                                                                                                                                                                                                                                                                                    |
| a)                       | Notice : Never take to pieces the module , because it will cause failure.                                                                                                                                                                                                                                          |
| b)                       | Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.                                                                                                                                                                                                  |
| c)                       | Connect GND to frame of module to stabilize against EMI and external noise.                                                                                                                                                                                                                                        |
| d)                       | Since there is a circuit board in the module back, stress is not added at the time of a design assembly. Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.                                                                                                        |
| e)                       | It causes an irregular display and the defective indication, etc., when always put constant pressure on the back of the module. Please do not make the structure to press the back of the module.                                                                                                                  |
| f)                       | Be careful of a back light FPC not to pull by force at the time of the connecting to a W-LED driver, or FPC processing.                                                                                                                                                                                            |
| g)                       | The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.                                                                                           |
| h)                       | Don't change the volume of LCD module. It is optimized when the shipping. Any change may not meet the specification.                                                                                                                                                                                               |
| i)                       | If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc.<br>Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.                                                                 |
| j)                       | To avoid a partial temperature change of LCD module, please consider the part arrangement and the design for the heat radiation.                                                                                                                                                                                   |
| k)                       | Be sure to follow the absolute maximum rating in the specification. The design should consider the surrounding temperature, the fluctuating input signal, and tolerance of the electronic parts. Exceeding values is possible to cause worse characteristic such as burn and/or broken of the parts on LCD module. |
| l)                       | Be sure to use LCD module within the recommended operating conditions. Operating module out of the recommended range is not guaranteed even if it is in the absolute maximum rating.                                                                                                                               |
| m)                       | Follow the power, signal, and supply voltage sequence which the specification indicates, regarding on-off input signal after power on of LCD module.                                                                                                                                                               |
| n)                       | According to the using application, power circuit protection is recommended at module failure.                                                                                                                                                                                                                     |

| 【Operation Precautions】 |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)                      | Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.                                                                                                                                                                                                                                                                                                                      |
| b)                      | When handling LCD modules and assembling them into cabinets, please avoid that long-terms storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the modules. Do not use the LCD module under such environment.                                                                                       |
| c)                      | An abnormal display by changing in quality of the polarizing plate might occur regardless of contact or no contact to the polarizing plate, because of epoxy resin (amine system curing agent) that comes out from the material and the packaging material used for the set side, the silicon adhesive (dealcoholization system and oxime system), and the tray blowing agents (azo-compound), etc. Please confirm adaptability with your employed material. |
| d)                      | Don't use polychloroprene (CR) with LCD module. It will generate chlorine gas, which will damage the reliability of the connection part on LCD panel.                                                                                                                                                                                                                                                                                                        |
| e)                      | Be careful when using it for long time with fixed pattern display as it may cause accidental image. Please use a screen saver etc., in order to avoid an afterimage.                                                                                                                                                                                                                                                                                         |
| f)                      | The LED (Light Emitting Diode) used in this LCD module is very sensitive to temperature change. If it operates for extremely long time under high temperature, it is possible rapidly to shorten the life time of LED. In case of such a condition, consult with us.                                                                                                                                                                                         |
| g)                      | If stored at the temperatures lower than the rated storage temperature, the LC may freeze and it may cause LCD panel damage. If storage temperature exceeds the specified rating, the molecular orientation of the LC may change to that of a liquid, and they may not revert to their original state. Store the module in normal room temperature.                                                                                                          |
| h)                      | Keep LCD module in the range of the specified temperature conditions at all times. Once out of the range, liquid crystal will lose its characteristics, and it cannot recover.                                                                                                                                                                                                                                                                               |
| i)                      | Nature of dew consideration prevention is necessary when LCD is used for long time under high-temperature and high-humidity.                                                                                                                                                                                                                                                                                                                                 |

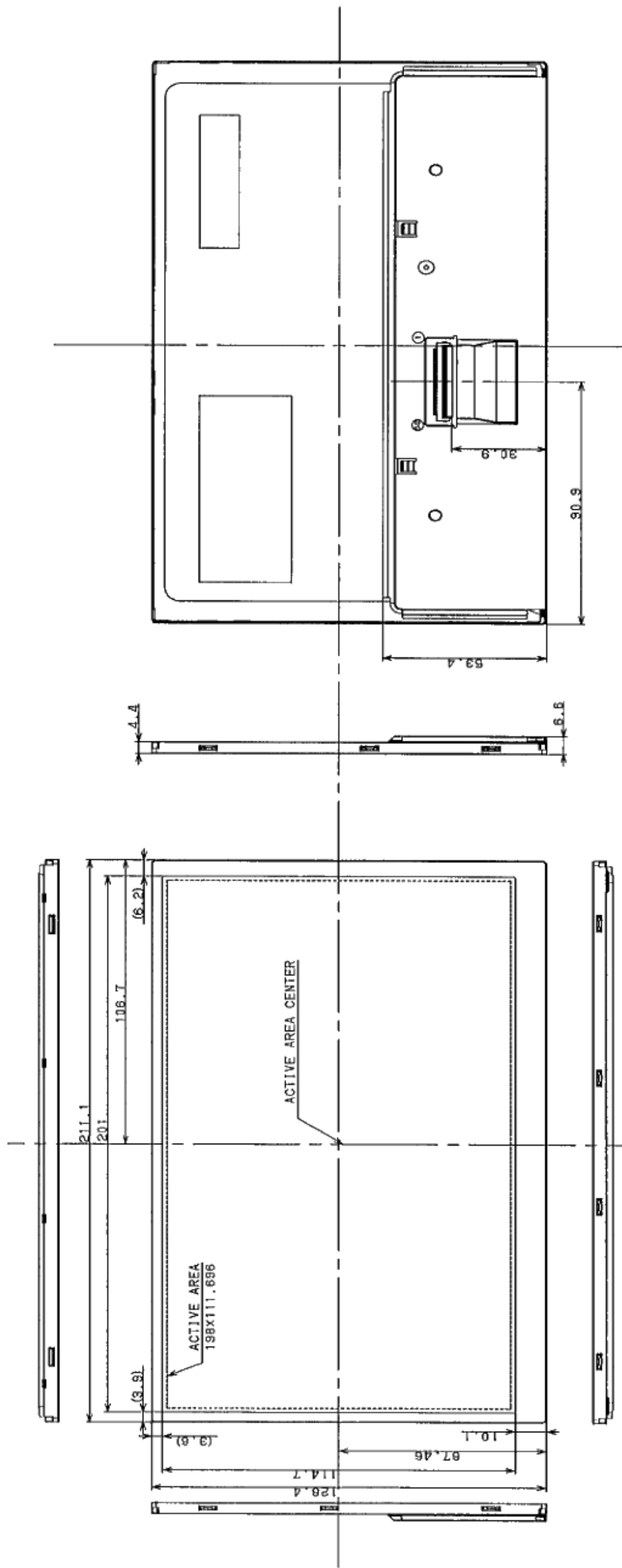
## 12. Packing form

|                                                   |                            |
|---------------------------------------------------|----------------------------|
| Product countries                                 | China                      |
| Piling number of cartons                          | Max. 6 cartons             |
| Package quantity in one carton                    | 50 pcs                     |
| Carton size                                       | 380mm(W) 313mm(H) 340mm(D) |
| Total mass of one carton filled with full modules | 15.5kg                     |
| Packing form is shown                             | Fig.2                      |

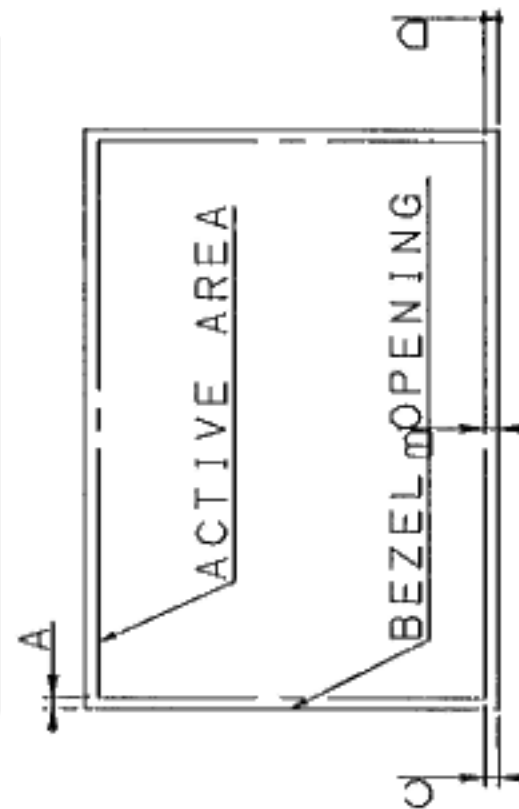
## 13. RoHS Directive

This LCD module is compliant with RoHS Directive.





Bezel/Display position



- 2) Tolerance Y direction B:  $1.5 \pm 0.8$
- 2) Tolerance Y direction B:  $1.5 \pm 0.8$
- 3) Obliquity of display area  $|C-D| < 0.8$

#### NOTES

- 1) Unspecified tolerance to be  $\pm 0.5$
- 2) Take care in set design to hide the scratches and bubbles appered on the polarizer or other flame area which is located outside of active area.
- 3) Please fix the module on the same plane, taking care not to wrap or twist the module.
- 4) Please avoid to press back panel by sharp edged item. And please confirm area pressed or contacted has no scratch/damage after vibration/shock test.

Fig.1 Outline Dimensions



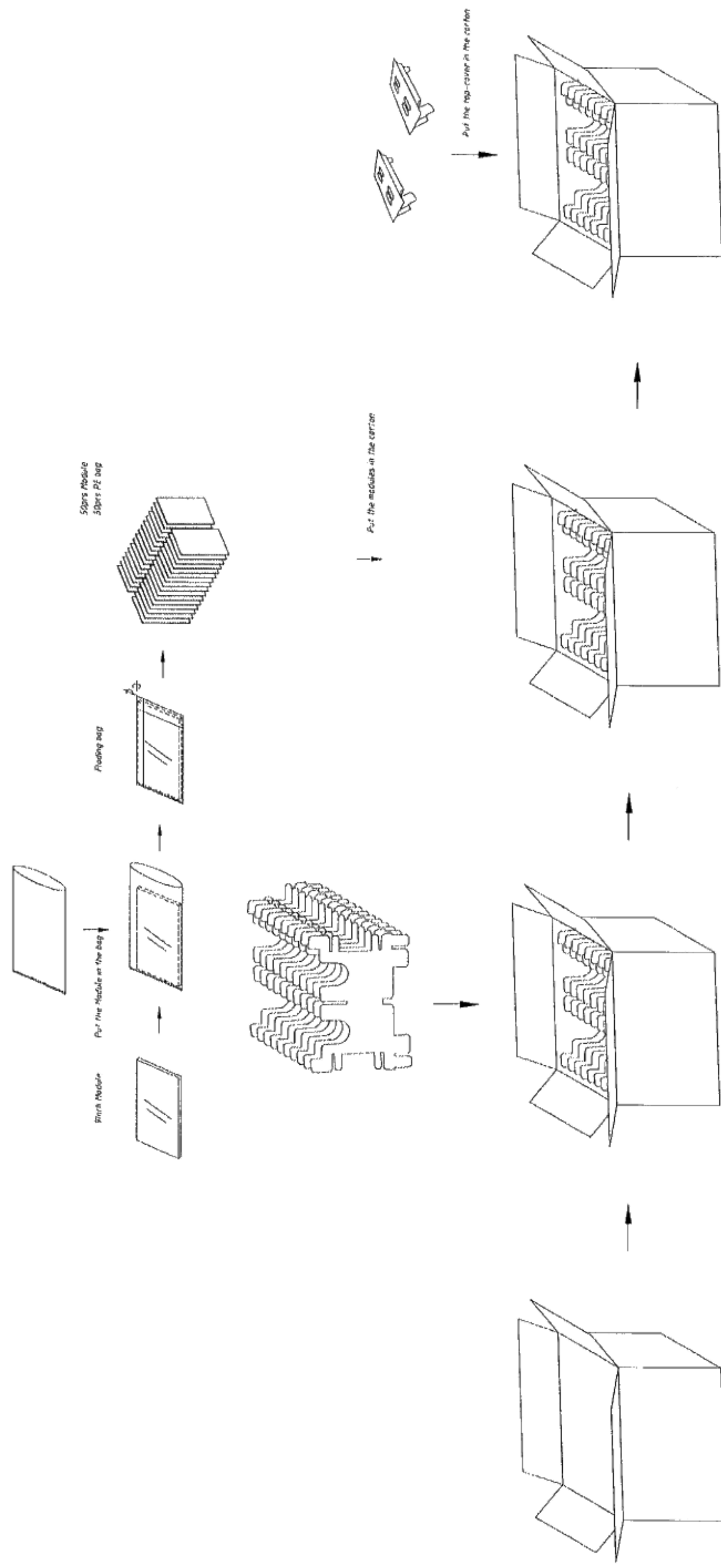


Fig.2 Packing form