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|------------------------|--|-------------------------------|
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|                        |  | DISPLAY DEVICE BUSINESS GROUP |

DEVICE SPECIFICATION FOR  
**TFT-LCD Module**  
 MODEL No.  
**LQ084V1DG43**

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

CUSTOMER' S APPROVAL

BY \_\_\_\_\_

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## 1. Application

This specification applies to color TFT-LCD module, LQ084V1DG43

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## 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, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a 640×3×480 dots panel with 262,144 colors by supplying 18 bit data signal (6bit/color), four timing signals, +3.3V/5.0V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

Viewing angle is 12 o'clock direction.

Backlight-driving LED controller is built in this module.

## 3. Mechanical Specifications

| Parameter           | Specifications                | Unit  |
|---------------------|-------------------------------|-------|
| Display size        | 21 (8.4") Diagonal            | cm    |
| Active area         | 170.9 (H)×128.2 (V)           | mm    |
| Pixel format        | 640 (H)×480 (V)               | pixel |
|                     | (1 pixel = R+G+B dots)        |       |
| Pixel pitch         | 0.267(H)×0.267 (V)            | mm    |
| Pixel configuration | R,G,B vertical stripe         |       |
| Display mode        | Normally white                |       |
| Surface treatment   | Anti-glare<br>Hard coating 3H |       |

| Parameter                             |        | Min.  | Typ.  | Max.  | Unit |
|---------------------------------------|--------|-------|-------|-------|------|
| Unit outline dimensions<br>[Note 3-1] | Width  | 220.5 | 221.0 | 221.5 | mm   |
|                                       | Height | 151.9 | 152.4 | 152.9 | mm   |
|                                       | Depth  | 8.8   | 9.3   | 9.8   | mm   |
| Mass                                  |        | —     | —     | 340   | g    |

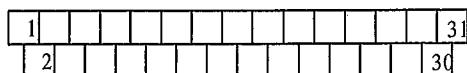
[Note 3-1] Outline dimensions is shown in Fig.1

## 4. Input Terminals

## 4-1. TFT-LCD panel driving

CNI Used connector: DF9MA-31P-1V(32)  
(Hirose Electric Co., Ltd.)

Corresponding connector: DF9-31S-1V(32)  
(Hirose Electric Co., Ltd.)



CNI pin arrangement from module surface  
(Transparent view)

DF9A-31S-1V(22) ( " )  
DF9B-31S-1V(32) ( " )  
DF9C-31S-1V(22) ( " )  
DF9M-31S-1V(32) ( " )

(※) Please do not use it besides corresponding connector

| Pin No. | Symbol | Function   | Remark  |
|---------|--------|--|---------|
| 1       | GND    |  |         |
| 2       | CK     | Clock signal for sampling each data signal       |         |
| 3       | Hsync  | Horizontal synchronous signal                    | 【Note1】 |
| 4       | Vsync  | Vertical synchronous signal                      | 【Note1】 |
| 5       | GND    |  |         |
| 6       | R0     | RED data signal(LSB)                             |         |
| 7       | R1     | RED data signal                                  |         |
| 8       | R2     | RED data signal                                  |         |
| 9       | R3     | RED data signal                                  |         |
| 10      | R4     | RED data signal                                  |         |
| 11      | R5     | RED data signal(MSB)                             |         |
| 12      | GND    |  |         |
| 13      | G0     | GREEN data signal(LSB)                           |         |
| 14      | G1     | GREEN data signal                                |         |
| 15      | G2     | GREEN data signal                                |         |
| 16      | G3     | GREEN data signal                                |         |
| 17      | G4     | GREEN data signal                                |         |
| 18      | G5     | GREEN data signal(MSB)                           |         |
| 19      | GND    |  |         |
| 20      | B0     | BLUE data signal(LSB)                            |         |
| 21      | B1     | BLUE data signal                                 |         |
| 22      | B2     | BLUE data signal                                 |         |
| 23      | B3     | BLUE data signal                                 |         |
| 24      | B4     | BLUE data signal                                 |         |
| 25      | B5     | BLUE data signal(MSB)                            |         |
| 26      | GND    |  |         |
| 27      | ENAB   | Signal to settle the horizontal display position | 【Note2】 |
| 28      | Vcc    | +3.3/5.0V power supply                           |         |
| 29      | Vcc    | +3.3/5.0V power supply                           |         |
| 30      | R/L    | Horizontal display mode select signal            | 【Note3】 |
| 31      | U/D    | Vertical display mode select signal              | 【Note3】 |

※The shielding case is connected with GND.

【Note1】 480 line, 400 line or 350 line mode is selected by the polarity combination of the both synchronous signals.

| Mode  | 480 lines | 400 lines | 350 lines |
|-------|-----------|-----------|-----------|
| Hsync | Negative  | Negative  | Positive  |
| Vsync | Negative  | Positive  | Negative  |

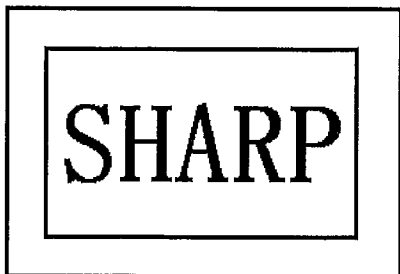
【Note2】 The horizontal display start timing is settled in accordance with a rising timing of ENAB signal.

In case ENAB is fixed "Low", the horizontal start timing is determined as described in 8-2.

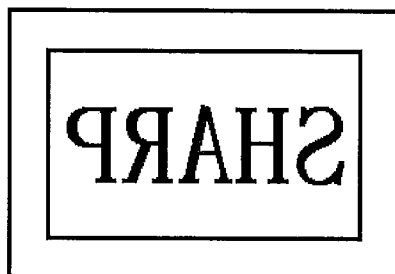
Don't keep ENAB "High" during operation.

[Note 3]

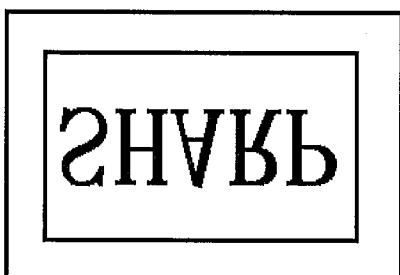
R/L = High, U/D = High



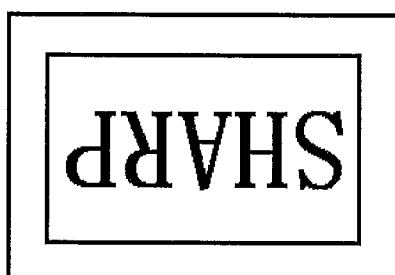
R/L = Low, U/D = High



R/L = High, U/D = Low



R/L = Low, U/D = Low



## 4-2. Backlight driving

CN2 Used connector : SM06B-SHLS-TF (J.S.T. Mfg. Co. Ltd)

Corresponding connector: SHLP-06V-S-B (J.S.T. Mfg. Co. Ltd)

| Pin no. | Symbol | Function                            |
|---------|--------|-------------------------------------|
| 1       | VDD    | Power supply for backlight          |
| 2       | VDD    | Power supply for backlight          |
| 3       | GND    | Ground for backlight                |
| 4       | GND    | Ground for backlight                |
| 5       | BL-EN  | ON/OFF control signal for backlight |
| 6       | PWM    | PWM signal for backlight dimming    |

## 5. Absolute Maximum Ratings

| Parameter             | Symbol           | Condition            | MIN              | MAX                    | Unit | Remark       |
|-----------------------|------------------|----------------------|------------------|------------------------|------|--------------|
| Supply voltage        | V <sub>CC</sub>  | T <sub>a</sub> =25°C | 0                | +6.0                   | V    |              |
|                       | V <sub>DD</sub>  | T <sub>a</sub> =25°C | 0                | +15.0                  | V    |              |
| Input voltage         | V <sub>I1</sub>  | T <sub>a</sub> =25°C | -0.3             | V <sub>CC</sub> +0.3   | V    | 【Note 1】     |
|                       | V <sub>I2</sub>  | T <sub>a</sub> =25°C | -0.3             | V <sub>DD</sub>        | V    | 【Note 2】     |
| Storage temperature   | T <sub>stg</sub> | -                    | -25              | +70                    | °C   | 【Note 4,5,6】 |
| Operating temperature | T <sub>opp</sub> | -                    | -10<br>(Ambient) | +70<br>(Panel surface) | °C   |              |

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

【Note 2】 BL-EN, PWM

【Note 3】 Humidity: 95%RH Max. (at  $T_a \leq 40^\circ\text{C}$ )

Maximum wet-bulb temperature at  $39^\circ\text{C}$  or less (at  $T_a > 40^\circ\text{C}$ )

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

【Note 4】 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  $T_a = +25^\circ\text{C}$ .

【Note 5】 Take care not to overrun ratings above.

## 6. Recommended operation condition

| Parameter      | Symbol    | Min. | Typ.      | Max.                   | Unit             | Remark  |
|----------------|-----------|------|-----------|------------------------|------------------|---------|
| Supply voltage | $V_{CC}$  | +3.0 | +3.3/+5.0 | +5.5                   | V                | [Note2] |
| Input voltage  | $V_I$     | 0    |           | $V_{CC}$               | V                | [Note1] |
| Temperature    | $T_{opa}$ | 0    |           | +70<br>(Panel surface) | $^\circ\text{C}$ | [Note3] |

[Note1] CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D

[Note2]

V<sub>CC</sub>-turn-on conditions

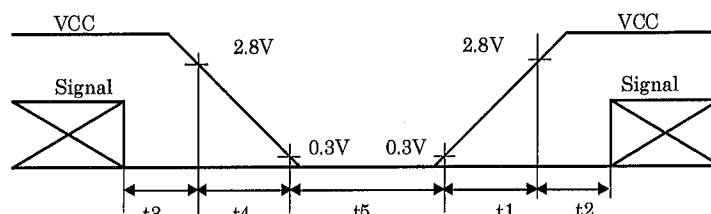
$$0.3\text{ms} < t_1 \leq 15\text{ms}$$

$$0 < t_2 \leq 20\text{ms}$$

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

$$1\text{s} < t_4$$

$$1\text{s} < t_5$$



V<sub>CC</sub>-dip conditions

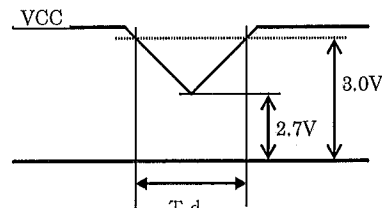
$$1) \quad 2.5\text{V} \leq V_{CC} < 3.0\text{V}$$

$$t_d \leq 10\text{ms}$$

$$2) \quad V_{CC} < 2.7\text{V}$$

V<sub>CC</sub>-dip conditions should also follow the

V<sub>CC</sub>-turn-on conditions



[Note3]

Humidity: 95%RH Max. at  $T_a \leq 40^\circ\text{C}$ .

Maximum wet-bulb temperature at  $39^\circ\text{C}$  or less at  $T_a > 40^\circ\text{C}$ .

No condensation.

7. Electrical Characteristics

7-1. TFT-LCD panel driving

Ta=25 °C

| Parameter                    | Symbol           | Min. | Typ. | Max.            | Unit   | Remarks                       |
|------------------------------|------------------|------|------|-----------------|--------|-------------------------------|
| Current dissipation          | I <sub>cc</sub>  | -    | 240  | 340             | mA     | V <sub>cc</sub> =3.3V [Note1] |
|                              |                  | -    | 150  | 210             | mA     | V <sub>cc</sub> =5.0V [Note1] |
| Allowed input ripple voltage | V <sub>RP</sub>  | -    | -    | 100             | mV p-p | V <sub>cc</sub> =3.3V         |
| Input voltage ("Low" state)  | V <sub>IL</sub>  | 0    | -    | 0.8             | V      | [Note2]                       |
| Input voltage ("High" state) | V <sub>IH</sub>  | 2.1  | -    | V <sub>cc</sub> | V      |                               |
| Input leakage current (low)  | I <sub>OL1</sub> | -    | -    | 10              | μA     | V <sub>I</sub> =0V [Note3]    |
|                              | I <sub>OL2</sub> | -800 | -    | -               | μA     | V <sub>I</sub> =0V [Note4]    |
| Input leakage current (High) | I <sub>OH</sub>  | -10  | -    | -               | μA     | V <sub>I</sub> =3.3V [Note2]  |

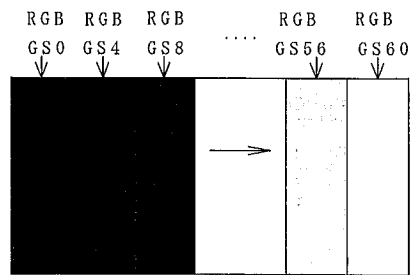
[Note1] Typical current situation: 16-gray-bar pattern.

(480Line Mode, V<sub>cc</sub>=+3.3V/+5.0V)

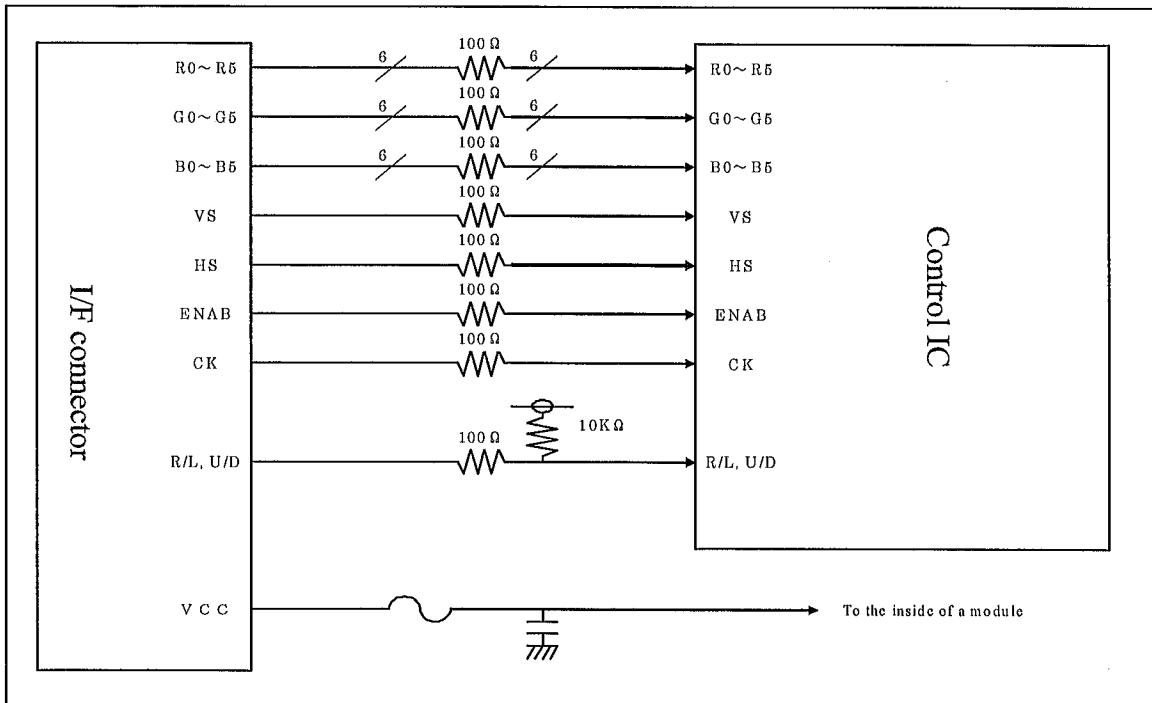
[Note2] CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D

[Note3] CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB,

[Note4] R/L, U/D



[Note5] See below block diagram of input interface.





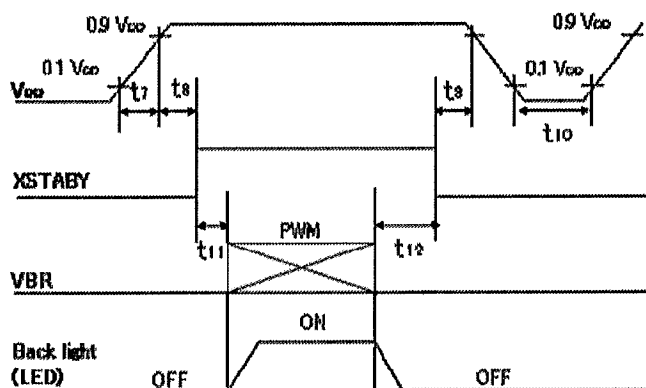
## 7-2. Backlight driving

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                   | $V_{DD}$              | 10.8           | 12.0               | 13.2  | V     | [Note1]                    |         |
| Current dissipation              | $I_{DD}$              | -              | 320                | 380   | mA    | [Note2]                    |         |
| Permissible input ripple voltage | $V_{RP\_BL}$          | -              | -                  | 200   | mVp-p |                            |         |
| BL-EN                            | Input voltage (High)  | $V_{IH\_BLEN}$ | 2.1                | -     | 5.5   | V                          | [Note3] |
|                                  | Input voltage (Low)   | $V_{IL\_BLEN}$ | 0                  | -     | 0.4   | V                          |         |
|                                  | Input leakage current | $I_{IL\_BLEN}$ | -                  | -     | 1.0   | mA                         |         |
| PWM                              | Input voltage (High)  | $V_{IH\_PWM}$  | 2.1                | -     | 5.5   | V                          | [Note4] |
|                                  | Input voltage (Low)   | $V_{IL\_PWM}$  | 0                  | -     | 0.4   | V                          |         |
|                                  | Input leakage current | $I_{IL\_PWM}$  | -                  | -     | 1.0   | mA                         |         |
| PWM frequency                    | $f_{PWM}$             | 200            | -                  | 1,000 | Hz    | [Note5]                    |         |
| PWM duty ratio                   | $D_{PWM}$             | 10             | -                  | 100   | %     |                            |         |
| Life time                        | L                     | -              | 70,000<br>(module) | -     | h     | Reference value<br>[Note6] |         |

[Note1] On-off conditions for supply voltage.



$$\begin{aligned}
 20\ \mu\text{s} &\leq t_7 \leq (200)\text{ms} \\
 0\text{ms} &\leq t_8 \leq (\text{TBD}) \\
 0\text{ms} &\leq t_9 \leq (\text{TBD}) \\
 (1)\text{s} &\leq t_{10} \\
 (100)\text{ms} &\leq t_{11} \leq (\text{TBD}) \\
 0\text{ms} &\leq t_{12} \leq (\text{TBD})
 \end{aligned}$$

[Note2] Current dissipation

Typ. value :  $V_{DD}=+12.0\text{V}$ , Duty=100%

Max. value :  $V_{DD}=+10.8\text{V}$ , Duty=100%

[Note3] BL-EN is connected by the pull-up resistor.

[Note4] PWM is connected by the pull-up resistor.

[Note5] PWM

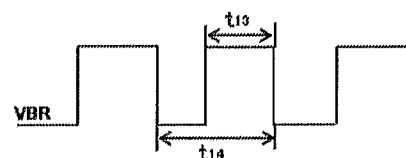
$$f_{PWM} = 1/t_{14}$$

Duty 10% : Min. Luminance

Duty 100% : Max. Luminance

Luminance changes in proportion to the duty ratio. ( $t_{13} \geq 500\ \mu\text{s}$ )

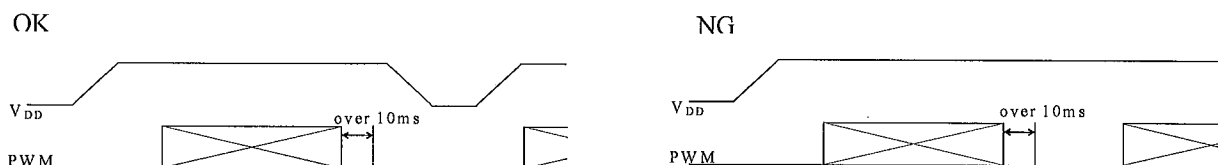
When the frequency slows, the display fineness might decrease.



[Note6] Luminance becomes 50% of an initial value. ( $T_a=25^{\circ}\text{C}$ , PWM=100%)

[Note7] When PWM signal is set "LOW" more than 10ms, please turn off  $V_{DD}$ .

If PWM signal is input without reset of  $V_{DD}$ , Softstart function of LED driving circuit is invalid and inrush current may occur.



## 8. Timing Characteristics of input signals

Timing diagrams of input signal are shown in Fig.2.

### 8-1. Timing characteristics

| Parameter                    |             | Symbol | Min.  | Typ.  | Max.   | Unit    | Remark       |
|------------------------------|-------------|--------|-------|-------|--------|---------|--------------|
| Clock                        | Frequency   | 1/Tc   | -     | 25.18 | 28.33  | MHz     | -            |
|                              | High time   | Tch    | 5     | -     | -      | ns      | -            |
|                              | Low time    | Tcl    | 10    | -     | -      | ns      | -            |
|                              | Duty ratio  | Th/T   | 40    | 50    | 60     | %       | -            |
| Data                         | Setup time  | Tds    | 5     | -     | -      | ns      | -            |
|                              | Hold time   | Tdh    | 10    | -     | -      | ns      | -            |
| Horizontal sync. signal      | Cycle       | TH     | 30.00 | 31.78 | -      | $\mu$ s | -            |
|                              |             |        | 750   | 800   | 900    | clock   | -            |
|                              | Pulse width | THp    | 2     | 96    | 200    | clock   | -            |
| Vertical sync. signal        | Cycle       | TV     | 515   | 525   | 560    | line    | 480line mode |
|                              |             |        | 446   | 449   | 480    | line    | 400line mode |
|                              |             |        | 447   | 449   | 510    | line    | 350line mode |
|                              | Pulse width | TVp    | 1     | -     | 34     | line    | -            |
| Horizontal display period    |             | THd    | 640   | 640   | 640    | clock   | -            |
| Hsync-Clock phase difference |             | THc    | 10    | -     | Tc-10  | ns      | -            |
| Hsync-Vsync phase difference |             | TVh    | 0     | -     | TH-THp | clock   | -            |

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

### 8-2. Horizontal display position

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.

| Parameter                            |             | symbol | Min. | Typ. | Max.   | Unit  | Remark |
|--------------------------------------|-------------|--------|------|------|--------|-------|--------|
| Enable signal                        | Setup time  | Tes    | 5    | -    | Tc-10  | ns    | -      |
|                                      | Pulse width | Tep    | 2    | 640  | 640    | clock | -      |
| Hsync-Enable signal phase difference |             | THE    | 44   | -    | TH-664 | clock | -      |

[Note] When ENAB is fixed "Low", the display starts from the data of C104(clock) as shown in Fig.2-①~③.

When the phase difference is below 104 clocks, keep the "High" level of ENAB signal longer than 104-THE clocks. If it will not be kept, the display starts from the data of C104 (clock).

Be careful that the module does not work when ENAB is fixed "High".

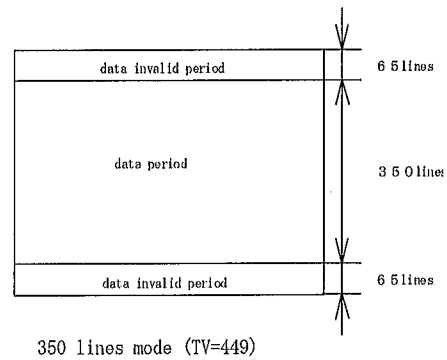
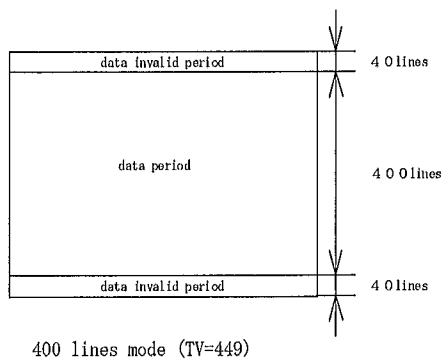
### 8-3. Vertical display position

The vertical display position is automatically centered in the active area at each mode of VGA, 480-, 400-, and 350-line mode. Each mode is selected depending on the polarity of the synchronous signals described in 4-1 (Note1).

In each mode, the data of TVn is displayed at the top line of the active area. And the display position will be centered on the screen like the following figure when the period of vertical synchronous signal (TV) is typical value.

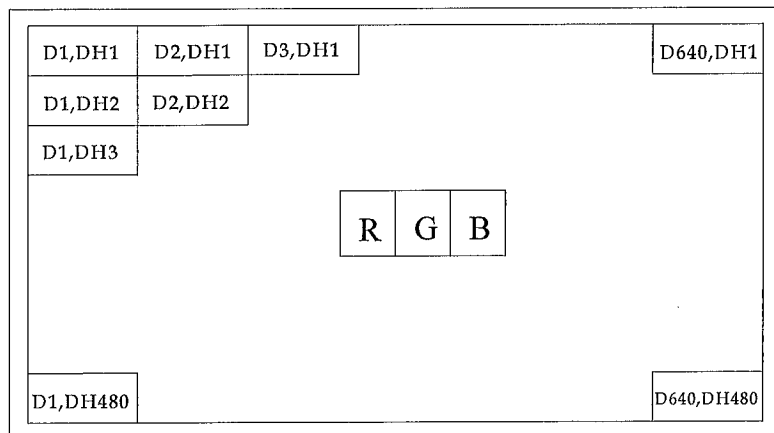
In 400-, and 350-line mode, the data in the vertical data invalid period is also displayed, so, inputting all data "0" is recommended during vertical data invalid period. ENAB signal has no relation to the vertical display position.

| Mode | V-data start<br>(TVs) | V-data period<br>(TVd) | V-display start<br>(TVn) | V-display period | Unit | Remark |
|------|-----------------------|------------------------|--------------------------|------------------|------|--------|
| 480  | 34                    | 480                    | 34                       | 480              | line | -      |
| 400  | 34                    | 400                    | 443-TV                   | 480              | line | -      |
| 350  | 61                    | 350                    | 445-TV                   | 480              | line | -      |



### 8-4. Input Data Signals and Display Position on the screen

Display position of input data (480 line mode)  
(H, V)



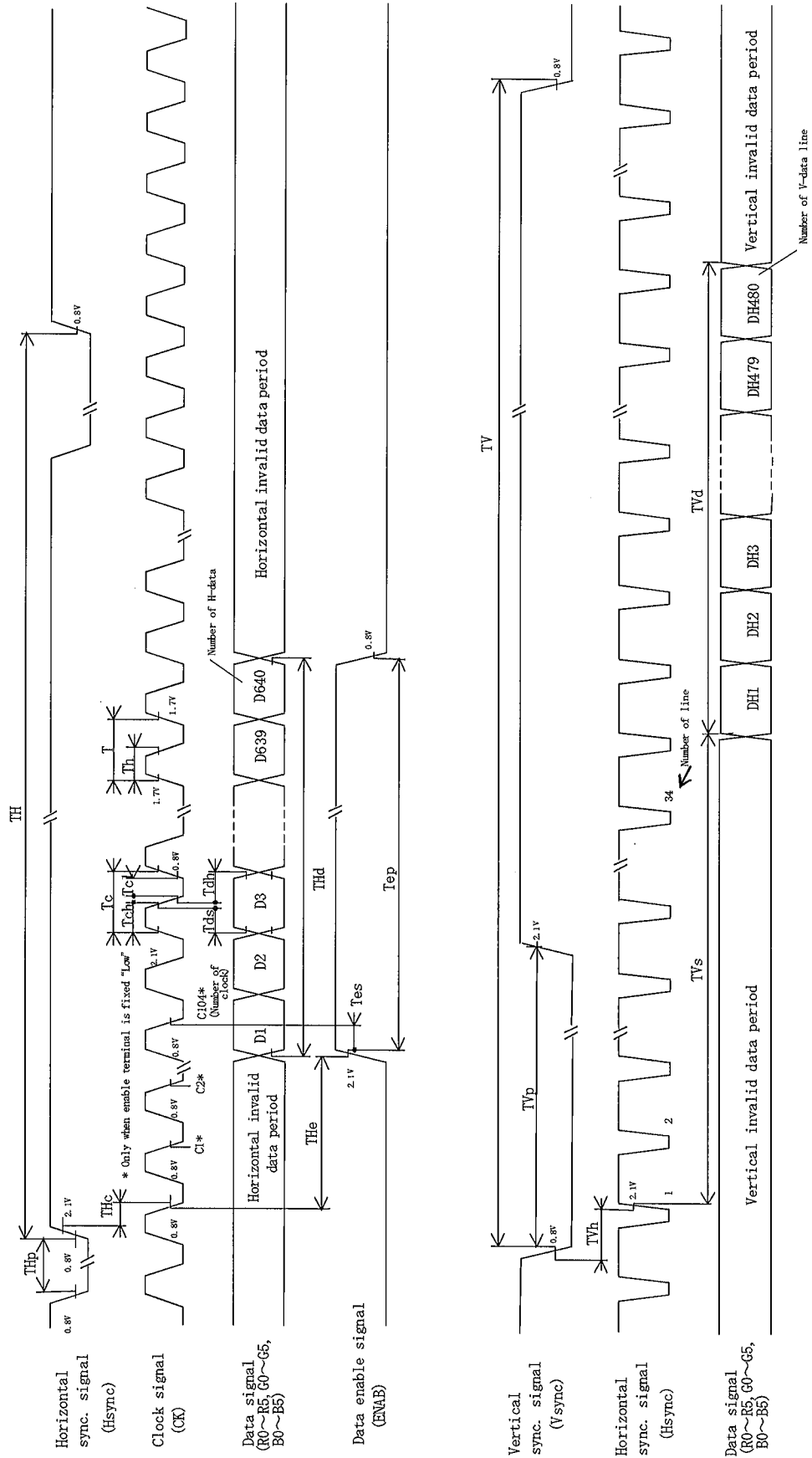


Fig 2-① Input signal waveforms (480 line mode)

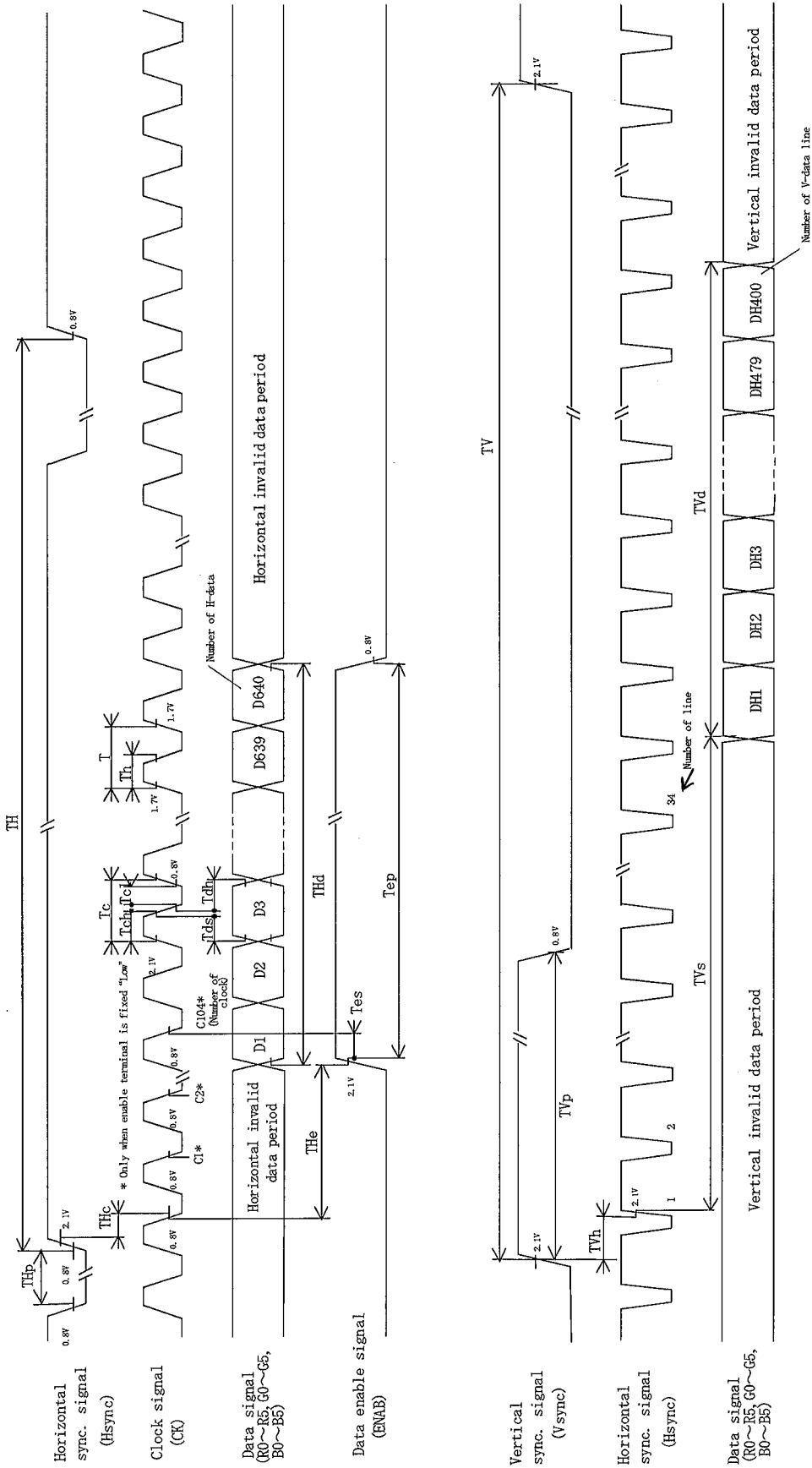


Fig2-2 Input signal waveforms (400 line mode)

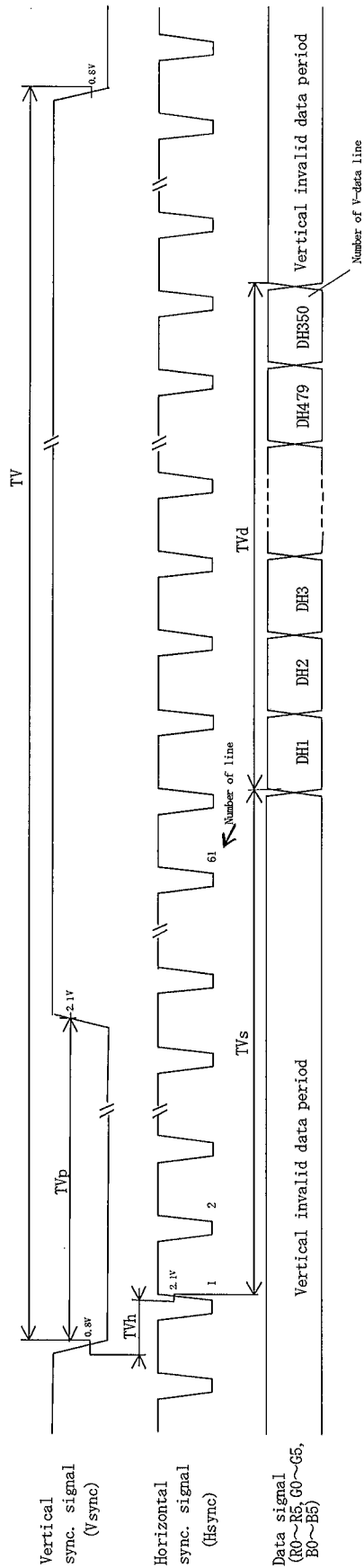
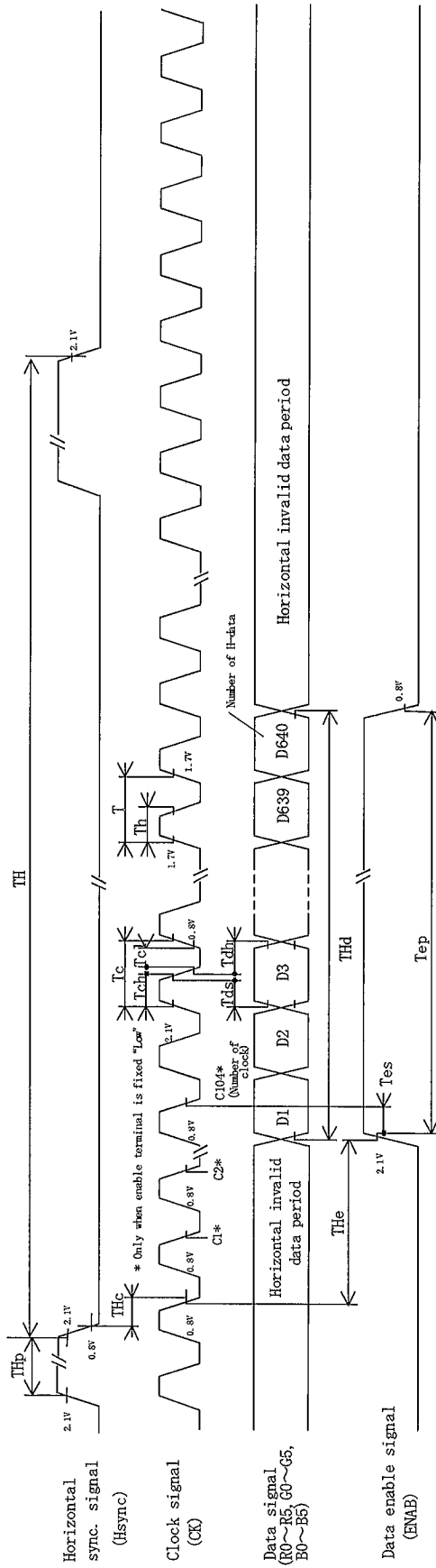


Fig 2-③ Input signal waveforms (350 line mode)

## 9. Input Signals, Basic Display Colors 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  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Cyan       | —           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Red        | —           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Magenta    | —           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow     | —           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White      | —           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale of Red   | Black      | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑          | GS1         | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker     | GS2         | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑          | ↓           |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |
|                     | ↓          | ↓           |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |
|                     | Brighter   | GS61        | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↓          | GS62        | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red        | GS63        | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Green | Black      | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑          | GS1         | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker     | GS2         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑          | ↓           |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |
|                     | ↓          | ↓           |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |
|                     | Brighter   | GS61        | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↓          | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green      | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Blue  | Black      | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ↑          | GS1         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  |
|                     | Darker     | GS2         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  |
|                     | ↑          | ↓           |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |
|                     | ↓          | ↓           |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    |    |
|                     | Brighter   | GS61        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  |
|                     | ↓          | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  |
|                     | Blue       | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

## 10. Optical Characteristics

Ta=25°C, Vcc=+3.3V / +5.0V

| Parameter             |            | Symbol                 | Condition             | Min.  | Typ.  | Max.  | Unit              | Remark             |
|-----------------------|------------|------------------------|-----------------------|-------|-------|-------|-------------------|--------------------|
| Viewing angle range   | Horizontal | $\theta 21, \theta 22$ | CR>10                 | 55    | 70    | -     | Deg.              | [Note1]            |
|                       | Vertical   | $\theta 11$            |                       | 50    | 60    | -     | Deg.              | [Note4]            |
|                       |            | $\theta 12$            |                       | 40    | 50    | -     | Deg.              | [Note4]            |
| Contrast ratio        |            | CR                     | Optimum viewing angle | -     | 600   | -     |                   | [Note2]<br>[Note4] |
| Response time         | Rise       | $\tau r$               | $\theta = 0^\circ$    | -     | 10    | -     | ms                | [Note3]            |
|                       | Decay      | $\tau d$               |                       | -     | 25    | -     | ms                | [Note4]            |
| Chromaticity of white |            | x                      |                       | 0.255 | 0.305 | 0.355 |                   | [Note4]            |
|                       |            | y                      |                       | 0.280 | 0.330 | 0.380 |                   |                    |
| Luminance of white    |            | $Y_L$                  |                       | 240   | 300   | -     | cd/m <sup>2</sup> |                    |
| White Uniformity      |            | $\delta W$             |                       | -     | -     | 1.45  |                   | [Note5]            |
| Viewing Angle         |            | -                      | -                     | 12    |       |       | o'clock           | [Note6]            |

[Note] The measurement shall be executed 30 minutes after lighting at rating.

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below. (condition: PWM Duty=100%)

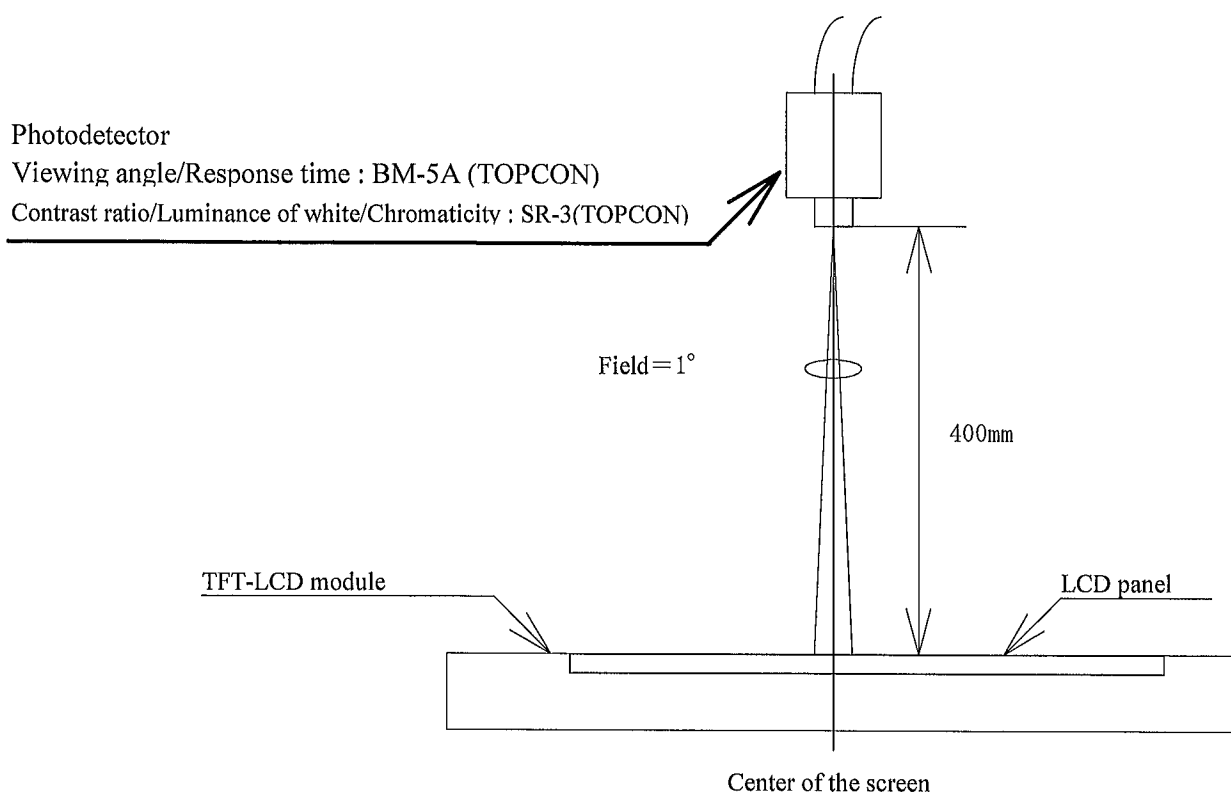
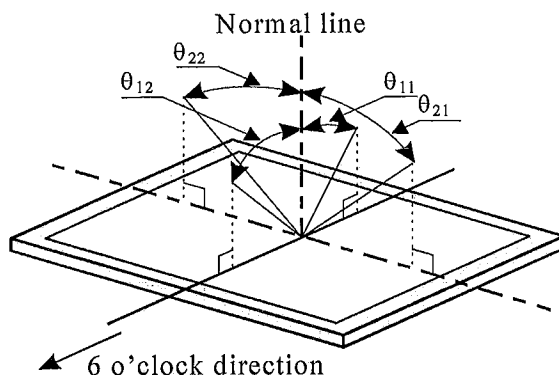


Fig.3 Optical characteristics measurement method



[Note1] Definitions of viewing angle range:



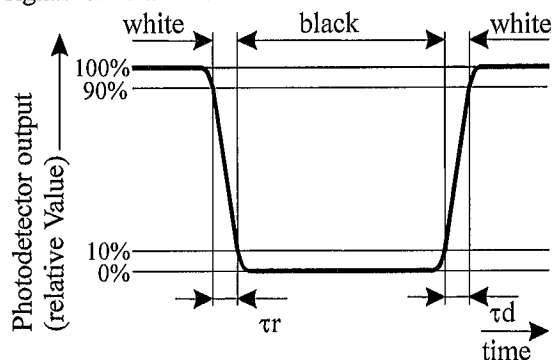
[Note2] Definition of contrast ratio:

The contrast ratio is defined as the following.

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

[Note3] 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".

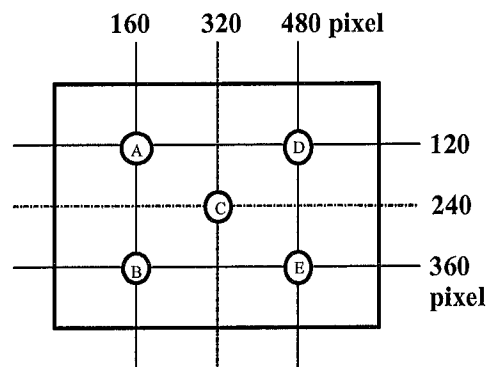


[Note4] This shall be measured at center of the screen.

[Note5] Definition of white uniformity:

White uniformity is defined as the following with five measurements (A~E).

$$\delta_w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$



[Note6] The optimum viewing angle of this module ( $\theta_{max}$ ) is slightly leaned to 12 o'clock from normal line.

Where  $\theta_{11} > \theta_{max}$ , gray scale is reversed partially.

Where  $\theta_{11} < \theta_{max}$ , or 6 o'clock direction, gray scale isn't reversed.

### 11. Display Quality

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

## 12. Handling Precautions

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
- b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- c) Since the front polarizer is easily damaged, pay attention not to scratch it.
- d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- 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) 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.
- i) 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 ionized nitrogen.
- j) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
- k) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.
- l) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.
- m) There are high voltage portions on the backlight. It is very dangerous to touch carelessly.  
It may lead to electrical shock. When exchanging lamps or getting service, turn off the power without fail.
- n) When handling LCD modules and assembling them into cabinets, please be avoid that long-term 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 LCD modules.
- o) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.
- p) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.
- q) When install LCD modules in the cabinet, please tighten with “torque= $0.294 \pm 0.02\text{N} \cdot \text{m}$ ( $3.0 \pm 0.2\text{kgf} \cdot \text{cm}$ )”.  
Be sure to confirm it in the same condition as it is installed in your instrument.
- r) 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.
- s) Notice: Never dismantle the module, because it will cause failure.  
Please don't remove the fixed tape, insulating tape etc. that was pasted on the original module.  
(Except for protection film of the panel and the crepe tape (yellow tape) of fixing lamp cable temporarily.)
- t) Be careful when using it for long time with fixed pattern display as it may cause afterimage.  
(Please use a screen saver etc., in order to avoid an afterimage.)
- u) Adjusting volume has been set optimally before shipment, so do not change any adjusted value.  
If adjusted value is changed, the specification may not be satisfied.
- v) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
- w) The lamp used for this product is very sensitive to the temperature.  
Luminance decreases rapidly when it is used for a long time or repeatedly under the environment of the low

temperature or the module is being cooled.

Please avoid the continuous or repeating use of it under such an environment.

It may decrease up to 50% of the initial luminance in about one month under the low temperature environment.

Please consult our company when it is used under the environment like the above mentioned.

### 13. Packing form

|   |                      |
|---|----------------------|
| Piling number of cartons                          | Max.8                |
| Package quantity in one carton                    | 20pcs                |
| Carton size(mm)                                   | 524(W)×411(D)×233(H) |
| Total mass of one carton filled with full modules | 10kg                 |

### 14. Reliability test items

| No. | Test item                                       | Conditions   | Remark            |
|-----|---|--|-------------------|
| 1   | High temperature storage test                   | Ta=70°C 240h   |                   |
| 2   | Low temperature storage test                    | Ta= -25°C 240h   |                   |
| 3   | High temperature & high humidity operation test | Ta=40°C ; 95%RH 240h<br>(No condensation)  |                   |
| 4   | High temperature operation test                 | Ta=70°C (Panel surface) 240h   |                   |
| 5   | Low temperature operation test                  | Ta= -10°C 240h   |                   |
| 6   | Vibration test<br>(non- operating)              | Frequency: 10~57Hz/Vibration width (one side) : 0.076mm<br>: 57~500Hz/Gravity : 9.8m/s <sup>2</sup><br>Sweep time : 11 minutes<br>Test period : 3 hours (1 hour for each direction of X,Y,Z) |                   |
| 7   | Shock test<br>(non- operating)                  | Max. gravity : 490m/s <sup>2</sup><br>Pulse width : 11ms, half sine wave<br>Direction : ±X, ±Y, ±Z once for each direction.  |                   |
| 8   | ESD test  | Contact discharge (150pF 330Ω)<br>non-operating = ±10kV, operating = ±8kV<br>Atmospheric discharge (150pF 330Ω)<br>non-operating = ±20kV, operating = ±15kV                                  |                   |
| 9   | EMI   | Measurement in 10m site<br>Display position on the screen = "H" (full-screen),<br>GND to 4 place = un-connect, Vcc / Vsignal = typ.  | VCCI<br>(Class B) |

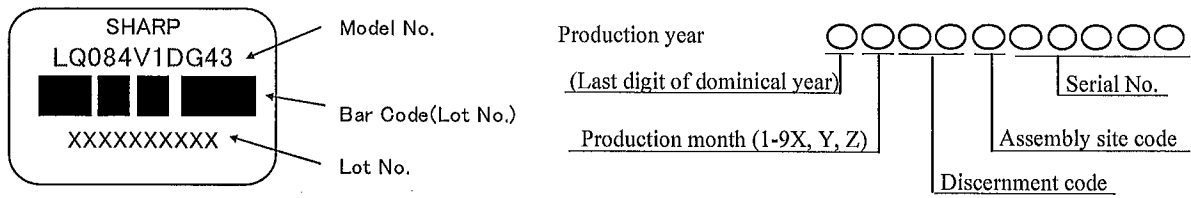
#### [Result Evaluation Criteria]

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

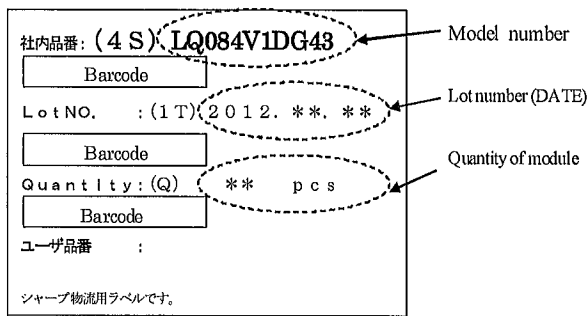
(normal operation state : Temperature:15~35°C, Humidity:45~75%, Atmospheric pressure:86~106kpa)

15. Others

15-1 Lot No. Label:



15-2 Packing box Label:



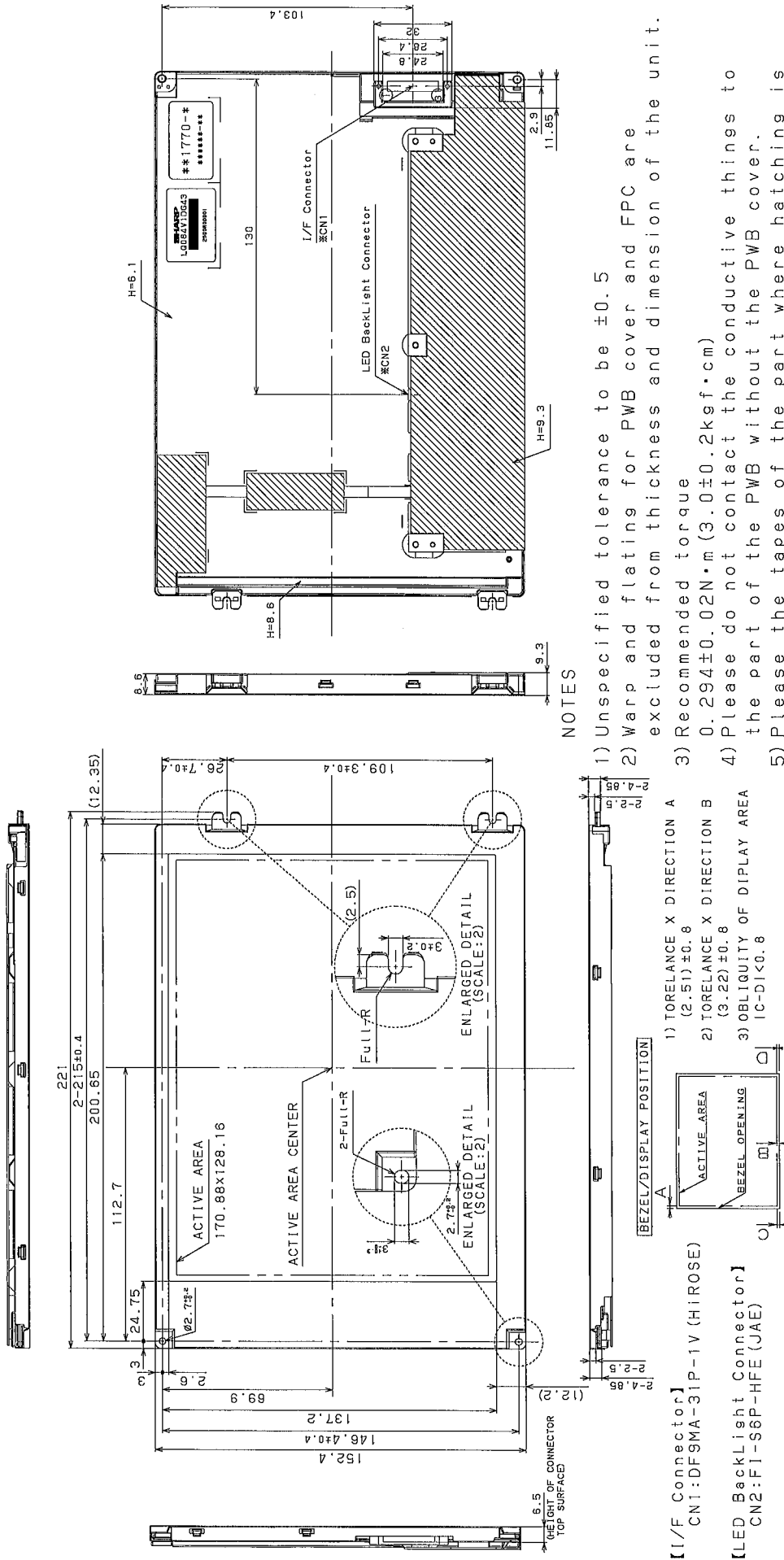
Internal Use Only  
R. C.

※R.C. (RoHS Compliance) means these parts have corresponded with the RoHS directive.

15-3 If any problem occurs in relation to the description of this specification , it shall be resolved through discussion with spirit of cooperation.

## 16. Carton storage condition

|                       |  |
|-----------------------|--|
| Temperature           | 0°C to 40°C  |
| Humidity              | 95%RH or less  |
| Reference condition : | 20°C to 35°C , 85%RH or less (summer)<br>: 5°C to 15°C , 85%RH or less (winter)<br>• the total storage time (40°C,95%RH) : 240H or less  |
| Sunlight              | Be sure to shelter a product from the direct sunlight.   |
| Atmosphere            | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.  |
| Notes                 | Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall<br>Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment |
| Storage period        | 1 year   |



NOTES

- 1) Unspecified tolerance to be ±0.5
- 2) Warp and flating for PWB cover and FPC are excluded from thickness and dimension of the unit.
- 3) Recommended torque 0.294±0.02N·m (3.0±0.2kgf·cm)
- 4) Please do not contact the conductive things to the part of the PWB without the PWB cover.
- 5) Please the tapes of the part where hatching is done are not peeled off.

Fig. 1 : LQ084VIDG43 OUTLINE DIMENSIONS

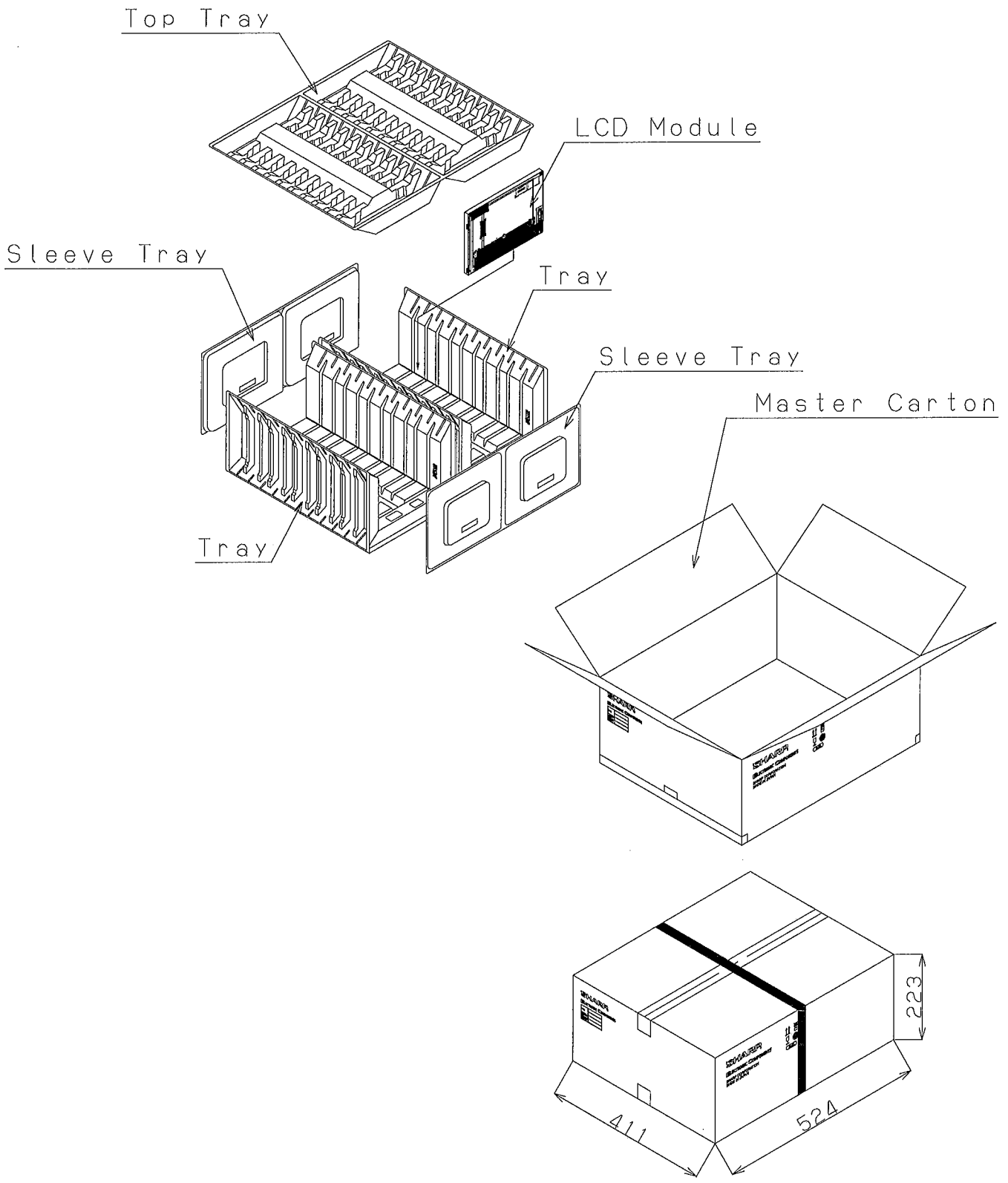


Fig. 3 : PACKING FORM