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DEVICE SPECIFICATION FOR  
**TFT - LCD module**  
 MODEL No. LQ065T9DZ01

CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

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**(1) Application**

This technical literature applies to color TFT-LCD module, LQ065T9DZ01.

**(2) Summary and Features**

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is practicable in both transmissive-type and reflection-type modes. It is composed of a color TFT-LCD panel, driver ICs, control/source-PWB, gate-PWB, frame, shielding front case, shielding back case and backlight unit. Graphics and texts can be displayed on a  $400 \times 3(\text{RGB}) \times 240$  dots panel with 262,144 colors by supplying 18 bit data signals(6 bit/color).

It isn't composed DC/AC inverter .

Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide-screen systems.

The 6.5 screen produces a high resolution image that is composed of 96,000 pixels elements in a stripe arrangement.

Wide viewing field angle technology is employed.

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

Reflection due to external light is minimized through the use of a low reflection, black matrix and an antiglare (AG) and antireflection(AR) plate.

AG and AR surface polarization plate is used.

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

Having considered vehicle-based use, the module contains a self heating backlight system whose emission characteristics are improved in low temperature.

**( 3 ) Mechanical specifications**

table 3-1

| Parameter              | Specifications                      | Units  | Remarks   |
|------------------------|-------------------------------------|--------|-----------|
| Display format         | 96,000                              | pixels |           |
|                        | 1,200(W) × 240(H)                   | dots   |           |
| Active area            | 143.4 ( W ) × 79.32 ( H )           | mm     |           |
| Screen size (Diagonal) | 16.4[6.5 " ]                        | cm     |           |
| Dot pitch              | 0.1195 ( W ) × 0.3305 ( H )         | mm     |           |
| Pixel configuration    | R,G,B Stripe configuration          |        |           |
| Outline dimension      | 155 ( W ) × 89.2 ( H ) × 12.5 ( D ) | mm     | 【Note3-1】 |
| Mass                   | 205 (MAX)                           | g      |           |

**【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: DF9MA-31P-1V (Gilding type: Hirose Electric Co., Ltd)

Fit connector: DF9 -31S-1V (Gilding type: Hirose Electric Co., Ltd)

( : A, B or M type)

Table 4-1 CN1

| Pin No. | Symbol  | Description  | Remarks   |
|---------|---------|--|-----------|
| 1       | V G H   | +10V power supply  |           |
| 2       | V S H   | +5V power supply   |           |
| 3       | V S H   | +5V power supply   |           |
| 4       | E N A B | Signal to settle the horizontal display position         | 【Note4-2】 |
| 5       | H V R   | Selection for horizontal and vertical scanning direction | 【Note4-3】 |
| 6       | B 5     | BLUE data signal(MSB)                                    |           |
| 7       | B 4     | BLUE data signal   |           |
| 8       | B 3     | BLUE data signal   |           |
| 9       | B 2     | BLUE data signal   |           |
| 10      | B 1     | BLUE data signal   |           |
| 11      | B 0     | BLUE data signal(LSB)                                    |           |
| 12      | G N D   | ground   |           |
| 13      | G 5     | GREEN data signal(MSB)                                   |           |
| 14      | G 4     | GREEN data signal  |           |
| 15      | G 3     | GREEN data signal  |           |
| 16      | G 2     | GREEN data signal  |           |
| 17      | G 1     | GREEN data signal  |           |
| 18      | G 0     | GREEN data signal(LSB)                                   |           |
| 19      | G N D   | ground   |           |
| 20      | R 5     | RED data signal(MSB)                                     |           |
| 21      | R 4     | RED data signal  |           |
| 22      | R 3     | RED data signal  |           |
| 23      | R 2     | RED data signal  |           |
| 24      | R 1     | RED data signal  |           |
| 25      | R 0     | RED data signal(LSB)                                     |           |
| 26      | V G L   | - 10V power supply                                       |           |
| 27      | V sync  | Vertical synchronous signal                              | 【Note4-1】 |
| 28      | H sync  | Horizontal synchronous signal                            | 【Note4-1】 |
| 29      | G N D   | ground   |           |
| 30      | C K     | Clock signal for sampling each data signal               |           |
| 31      | G N D   | ground   |           |

【Note 4-1】

|       |          |
|-------|----------|
| Hsync | Positive |
| Vsync | Positive |

【Note 4-2】

The horizontal display start timing is settled in accordance early for 4 pixels from a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in Fig7-1.

(Don't keep ENAB "High" during operation.(7-2).)

【Note 4-3】

HVR = "High": Regular video

HVR = "Low" : Horizontally and Vertically inverted video

## 4-2) Backlight fluorescent tube driving part

Used connector:BHR-04VS-1(Gilding type: JST Co.,Ltd)

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

Table 4-2 terminal: CN2

| No. | symbol | i /o | function                          | Color of FL cable |
|-----|--------|------|-----------------------------------|-------------------|
| 1   | VL1    | i    | input terminal(Hi voltage side)   | ORANGE            |
| 2   | NC     | -    | non connection                    |                   |
| 3   | VL2    | i    | input terminal (Low voltage side) | BLACK             |

## 4-3)Backlight operating part

Table 4-3

| terminal | No. | symbol | remarks    |
|----------|-----|--------|------------|
| CN3      | 1   | T H 1  | Thermistor |
|          | 2   | T H 2  | Thermistor |

【Note4-4】 Use for the detection of the lamp temperature.

Kind of thermistor :203GT-1(Gilding type: Ishizuka Electric Co.,Ltd)

Zero load resistance value about 25 :20k ±3%

## (5)Absolute maximum ratings

Table 5-1

GND = 0 V

| Parameter  | Symbol | M I N | M A X | Unit | Note             |
|--|--------|-------|-------|------|------------------|
| Input voltage                                    | $V_I$  | -0.3  | +3.6  | V    | 【Note 5-1,7】     |
| +5V power supply                                 | V S H  | 0     | +6.0  | V    | 【Note 5-7】       |
| +10Vpower supply High                            | 0      | +12   | +12   | V    | 【Note 5-7】       |
| - 10Vpower supply Low                            | 0      | -12   | - 12  | V    | 【Note 5-7】       |
| Storage temperature                              | T stg  | -40   | +95   |      | 【Note 5-2,3,6】   |
| Operating temperature<br>( panel surface )       | T opr1 | -40   | +85   |      | 【Note 5-2,3,4,6】 |
| Operating temperature<br>( Ambient temperature ) | T opr2 | -40   | +80   |      | 【Note 5-5,6】     |

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

【Note 5-2】 This rating applies to all parts of the module and should not be exceeded.

【Note 5-3】 Maximum wet-bulb temperature is less than 49 . Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

【Note 5-4】 The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, determine operating temperature using the formula  $T_a = +25$ 

【Note 5-5】 If the environment temperature will be over +80°C, lamp current must be reduced in order to keep the agreed panel operating temperature of +85°C.

【Note 5-6】 Refer to Table 15-1

【Note 5-7】  $T_p = -40 \sim +95$ 

【Note 5-8】 85°C 240h; 95° 120h

【Note 5-9】 Operating temperature between -40°C to -31°C does not provide a correct image on the LCD, but no damage of the display function will occur

Reduced requirements for operation

60013 Temperature tests are made without polarizers  
(humidity problem during temperature cycles).

High environment temperature operation is not the typical operation of the display;  
1500h have been tested with a small degradation of polarizer

BMW S 60013 Part 1

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

Table 6-1

GND = 0 V , T<sub>p</sub>= 30 ~ 85

| Parameter               |                     | Symbol          | MIN  | TYP   | MAX   | Unit             | Remarks                            |
|-------------------------|---------------------|-----------------|------|-------|-------|------------------|------------------------------------|
| +5V                     | Supply voltage      | VSH             | +4.5 | +5.0  | +5.5  | V                | 【Note 6-1】                         |
|                         | Current dissipation | ISH             | -    | 28    | 50    | mA               | 【Note 6-2】                         |
| +10V                    | Supply voltage      | VGH             | +9.5 | +10.0 | +10.5 | V                |                                    |
|                         | Current dissipation | IGH             | -    | 25    | 32    | mA               | 【Note 6-2】                         |
| - 10V                   | Supply voltage      | VGL             | -9.5 | -10.0 | -10.5 | V                |                                    |
|                         | Current dissipation | IGL             | -    | -22   | -30   | mA               | 【Note 6-2】                         |
| Permissive input ripple |                     | V <sub>RF</sub> | -    | -     | 100   | mV <sub>pp</sub> |                                    |
| Input Low voltage       |                     | V <sub>IL</sub> | -    | 0     | 0.9   | V                | 【Note 6-3】                         |
| Input High voltage      |                     | V <sub>IH</sub> | 2.3  | 3.3   | -     | V                |                                    |
| Input current (Low)     |                     | I <sub>IL</sub> | -    | -     | 1.0   | μA               | V <sub>I</sub> =0V<br>【Note 6-3】   |
| Input current (High)    |                     | I <sub>IH</sub> | -    | -     | 1.0   | μA               | V <sub>I</sub> =3.3V<br>【Note 6-3】 |

Turn on :VGL VSH VGH or same time

Turn off :VGH VSH VGL or same time

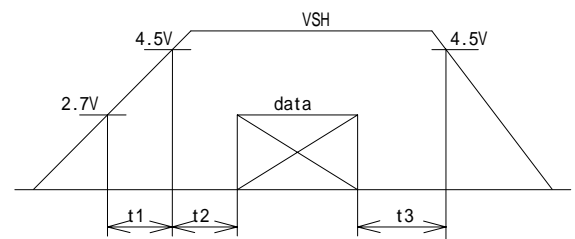
【Note 6-1】

VSH-turn-on conditions

t<sub>1</sub> 10ms

0 < t<sub>2</sub> 10ms

0 < t<sub>3</sub> 1s



VSH-dip conditions

VSH-dip conditions should also follow the VSH-turn-on conditions.

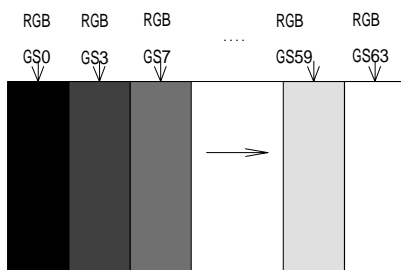
【Note 6-2】

Typical current situation:64-gray-bar pattern Timing; CK=25MHz

Max current situation: Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42)

every 1 dot. Timing; CK=25MHz

VSH=+5.0V VGH=+10V VGL= - 10V HVR="High"



Typical current situation



Max current situation

【Note 6-3】 CK,R0 ~ R5,G0 ~ G5,B0 ~ B5,Hsync,Vsync,ENAB,HVR

6-2) Backlight driving section

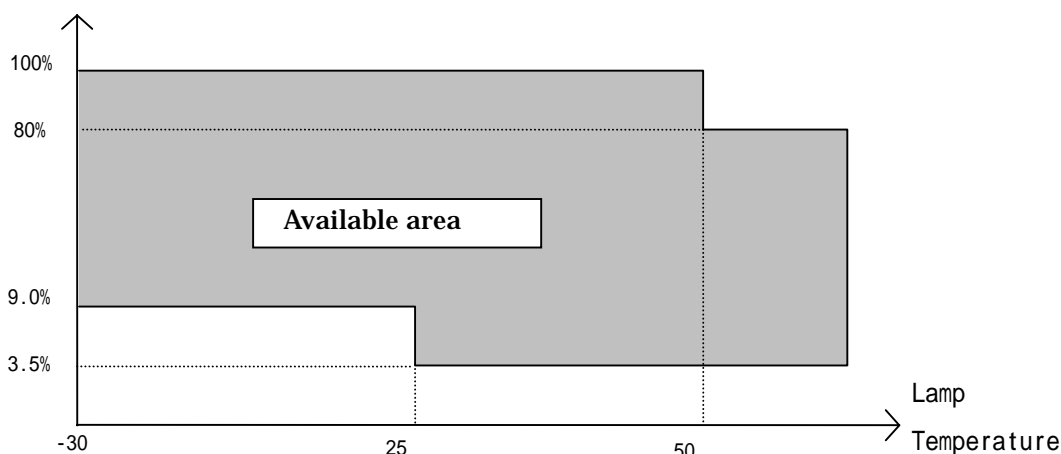
The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube). The characteristics of Lamp are shown in the following table.

Table 6-2

| Parameter        | Symbol   | MIN | TYP  | MAX  | Unit              | Remarks                        |
|------------------|----------|-----|------|------|-------------------|--------------------------------|
| lamp voltage     | $V_{L7}$ | 630 | 700  | 770  | Vrms              | $I_L = 6.5\text{mA}_{rms}$     |
| lamp current     | $I_L$    | 6.0 | 6.5  | 7.0  | mA <sub>rms</sub> | Ordinary state                 |
|                  | $I_{LB}$ | -   | -    | 9.0  | mA <sub>rms</sub> | PWM dimming state<br>【Note6-1】 |
| lamp frequency   | $f_L$    | 35  | -    | 100  | kHz               |                                |
| kick-off voltage | $V_S$    | -   | -    | 3000 | Vrms              | $T_a = +25$ 【Note6-2】          |
|                  |          | -   | -    | 3000 | Vrms              | $T_a = -30$ 【Note6-2】          |
| kick-off voltage | $V_{LS}$ | -   | 1460 | 1820 | Vrms              | $T_a = +25$ 【Note6-2】          |
|                  |          | -   | 1460 | 1820 | Vrms              | $T_a = -30$ 【Note6-2】          |
| Ignition time    | $T_I$    |     |      | 1    | sec               | $T_a = +25$                    |
|                  |          |     |      | 1    | sec               | $T_a = -30$                    |

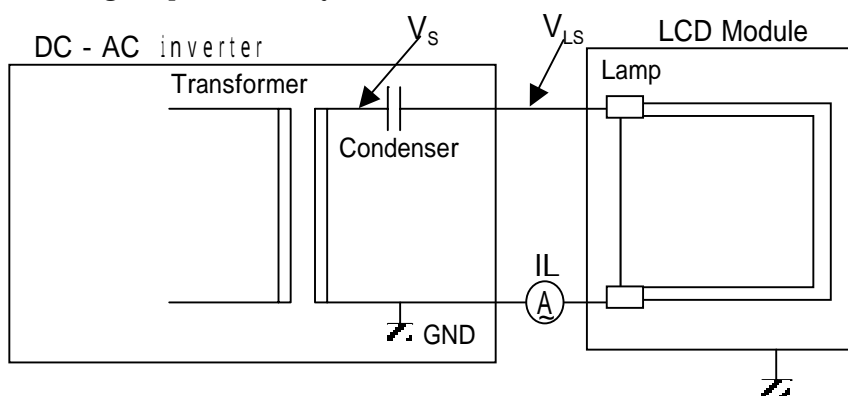
Inverter: HIU-288 [Harison Toshiba Lighting Corp.] (Output capacitor :  $C=12\text{pF}$ , frequency: 49kHz)

【Note6-1】 Dimming



【Note6-2】 The kick-off voltage is specified under the condition in just putting the backlight on the LCD module. (The backlight cable is not unbent.)

The kick-off voltage depends on way to lead the cable between inverter and backlight.



【caution】

Please use the inverter which has the one of the sine wave. With regards to the inverter, it should be negative/positive wave symmetry and the spike wave should not be occurred.



(7)Timing Characteristics of input signals

Timing diagrams of input signal are shown in Fig.7-1,2

7-1) Timing characteristics

Table 7-1

Tp=-30 ~ 85

| Parameter                     |             | Symbol | MIN  | TYP   | MAX    | Unit  | Remarks    |
|-------------------------------|-------------|--------|------|-------|--------|-------|------------|
| Clock                         | frequency   | 1/Tc   | -    | -     | 25     | MHz   |            |
|                               | High time   | Tch    | 18   | -     | -      | ns    |            |
|                               | Low time    | Tcl    | 18   | -     | -      | ns    |            |
| Data                          | Setup time  | Tds    | 5    | -     | -      | ns    |            |
|                               | Hold time   | Tdh    | 10   | -     | -      | ns    |            |
| Horizontal sync. signal       | Cycle       | TH     | 59.1 | -     | 76.92  | μs    |            |
|                               |             |        | 680  | 800   | 1675   | clock |            |
|                               | Pulse width | THp    | 4    | 48    | 96     | clock |            |
| Vertical sync. signal         | Cycle       | TV     | 14.7 | 16.67 | 22.65  | ms    | 【Note 7-1】 |
|                               |             |        | 260  | -     | 282    | line  |            |
|                               | Pulse width | TVp    | 3    | 4     | 128    | line  |            |
| Horizontal display period     |             | THd    | 400  | 400   | 400    | clock |            |
| Vertical display period       |             | TVd    | 240  | 240   | 240    | line  |            |
| Hsync-Clock phase difference  |             | THc    | 5    | Tc/2  | TH - 5 | ns    |            |
| Hsync-Vsync phase difference  |             | TVh    | - 10 | -     | +10    | clock | 【Note 7-2】 |
| Vertical display invalid line |             | TVe    | 7    | 7     | 7      | line  |            |

【Note 7-1】 To be driven with more than 50Hz(TV<=20ms).

If less than 50Hz(TV>=20ms),the flicker might be occur gradually.

【Note 7-2】 TH The+673clock

7-2) Horizontal display position

The horizontal display position is determined by ENAB signal.

The input data corresponding to the rising edge of ENAB signal is displayed at the left end of the Active area. (See Fig7-1)

Tp=-30 ~ 85

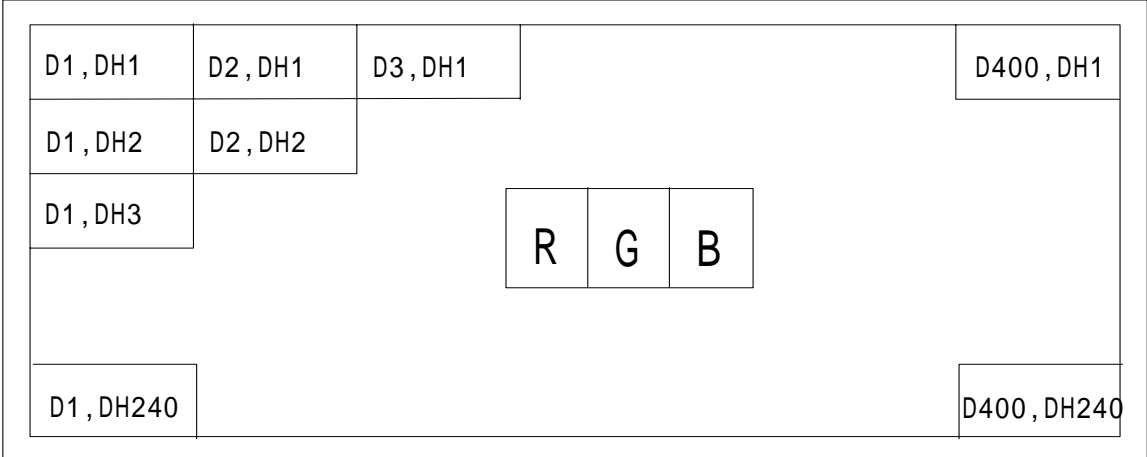
| Parameter                            |             | Symbol | MIN. | TYP. | MAX.    | Unit  | Remark     |
|--------------------------------------|-------------|--------|------|------|---------|-------|------------|
| Enable signal                        | Setup time  | Tes    | 5    | Tc/2 | Tc - 5  | ns    |            |
|                                      | Pulse width | Tep    | 10   | -    | TH - 10 | clock |            |
| Hsync-Enable signal phase Difference |             | The    | 5    | 16   | 256     | clock | 【Note 7-3】 |

Note) When ENAB is fixed "Low", the display starts from the data of 16 clock (C16) as shown in Fig.7-2.

【Note 7-3】 The TH - 673clock

【Note 7-4】 Enable signal must be input into Vertical invalid data period as well as Vertical display period.

7-3) Input Data Signals and Display Position on the screen



Display position of input data (H,V)

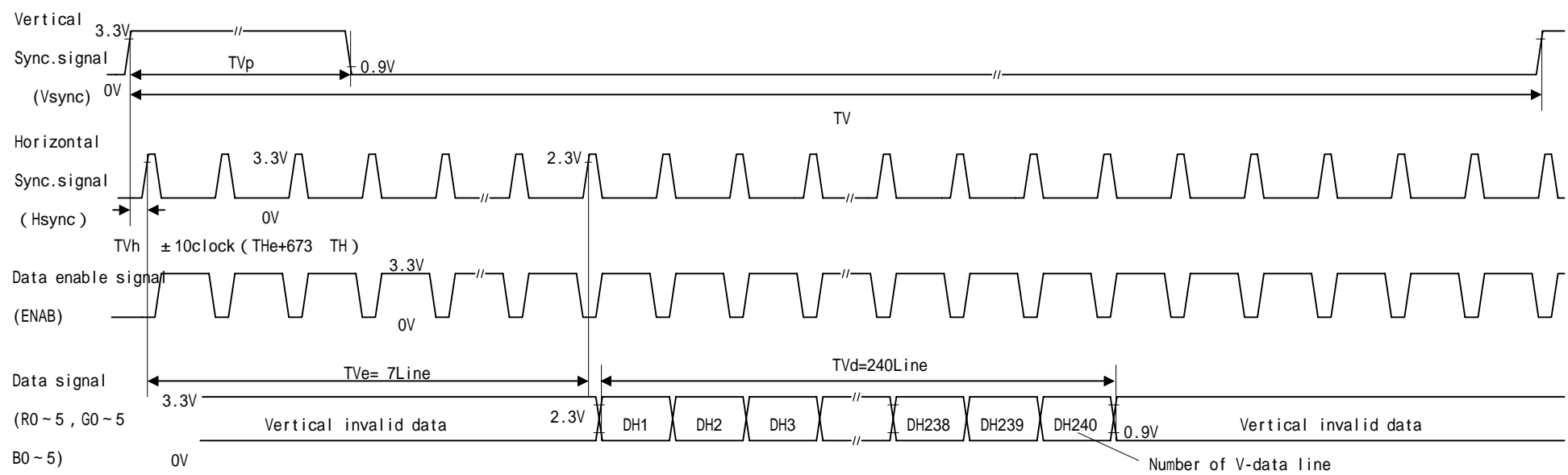
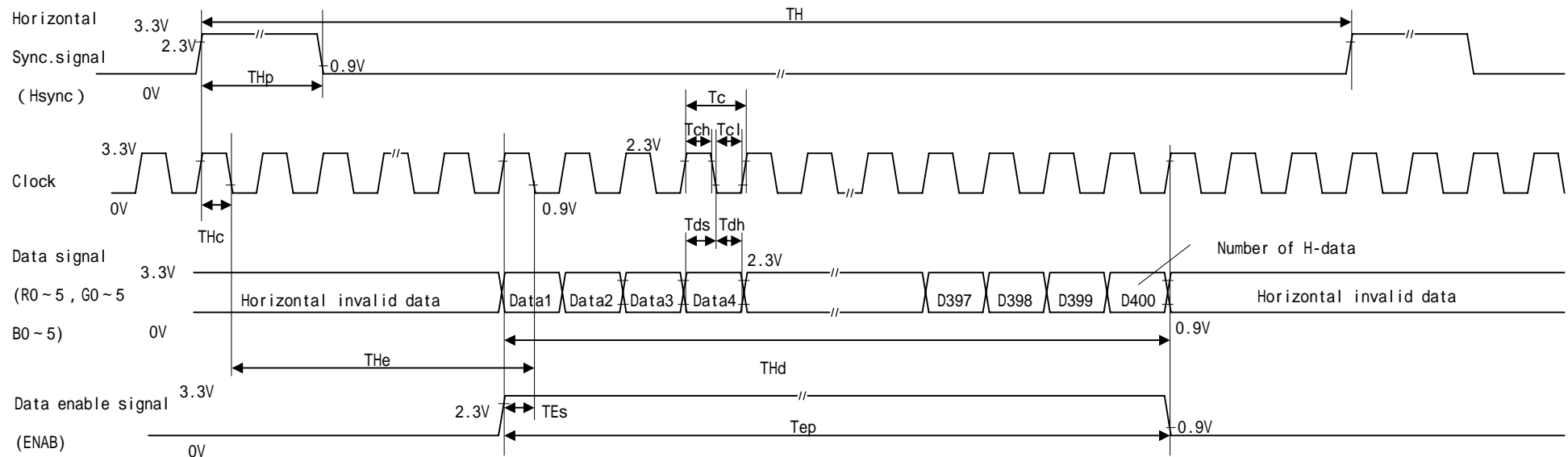


Fig.7-1 Input signal waveforms (ENAB:active)

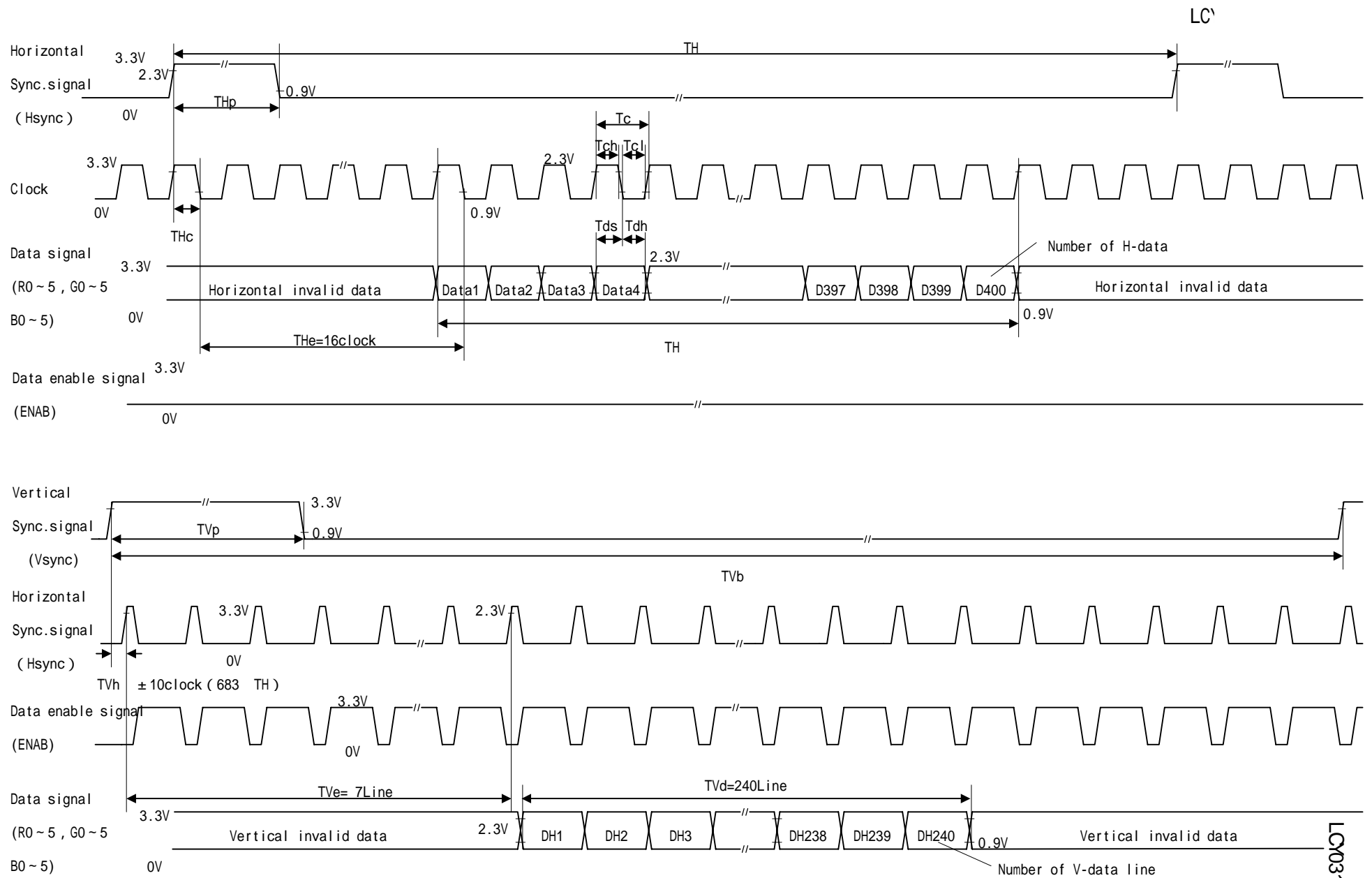


Fig.7-2 Input signal waveforms (ENAB:Low)

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

|                     | Colors & Gray scale | Data signal |    |    |    |    |    |    |    |    |    |    |    |    |    | 0 :Low level voltage |    | 1 :High level voltage |    |    |
|---------------------|---------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----------------------|----|-----------------------|----|----|
|                     |                     | 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 bleu  | Black               | GS0         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                    | 0  | 0                     | 0  | 0  |
|                     | ↑                   | GS1         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0                    | 0  | 0                     | 0  | 0  |
|                     | Darker              | GS2         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1                    | 0  | 0                     | 0  | 0  |
|                     | ↑                   | ↓           |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓                    |    |                       |    |    |
|                     | ↓                   | ↓           |    |    |    | ↓  |    |    |    |    | ↓  |    |    |    |    | ↓                    |    |                       |    |    |
|                     | Brighter            | GS61        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0                    | 1  | 1                     | 1  | 1  |
|                     | ↓                   | GS62        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1                    | 1  | 1                     | 1  | 1  |
|                     | Bleu                | GS63        | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1                    | 1  | 1                     | 1  | 1  |

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

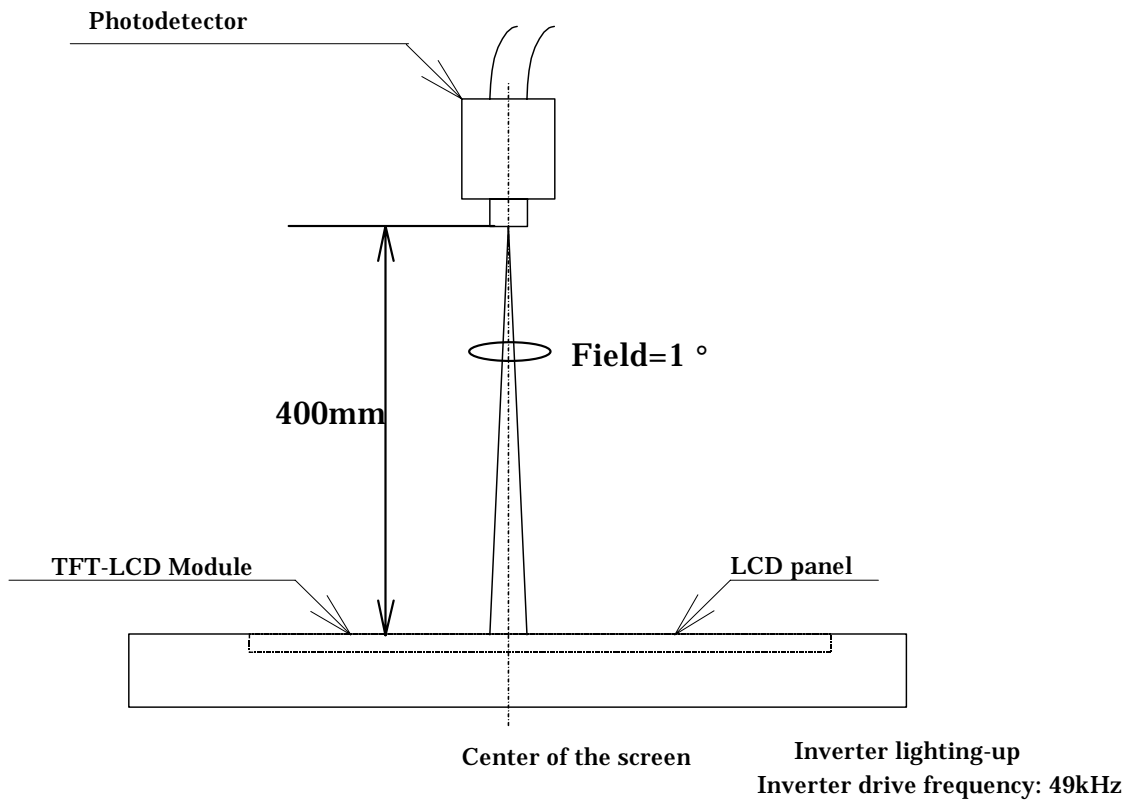
Ta=25 , VSH=+5V,VGH=+10V,VGL= - 10V

| Parameter         |                                     | Symbol            | Condition                      | Min         | Typ     | Max     | Unit       | Remarks           |            |
|-------------------|-------------------------------------|-------------------|--------------------------------|-------------|---------|---------|------------|-------------------|------------|
| Transmissive mode | Viewing angle range                 | 11/ 12/<br>21/ 22 | CR 10                          | 50          | 60      | -       | ° (degree) | 【Note 9-1】        |            |
|                   | Contrast ratio                      | CRmax             | Optimal Viewing angle<br>= 0 ° | 150         | -       | -       |            | 【Note 9-2】        |            |
|                   |                                     |                   |                                | 60          | -       | -       |            |                   |            |
|                   | Response time                       | Rise              | r                              | = 0 °       | -       | (25)    | (50)       | ms                | 【Note 9-3】 |
|                   |                                     | Fall              | d                              |             | -       | (10)    | (30)       | ms                |            |
|                   | Luminance                           |                   | Y                              | IL=6.5mArms | 180     | 250     | -          | cd/m <sup>2</sup> | 【Note 9-4】 |
|                   | Cold brightness's standing-up[-20 ] |                   | Y <sub>LOW</sub>               | IL=9.0mArms | -       | 60      | -          | %                 | 【Note 9-5】 |
|                   | chromaticity                        | Whit e            | x                              | IL=6.5mArms | 0.263   | 0.313   | 0.363      |                   | 【Note 9-4】 |
|                   |                                     |                   | y                              |             | 0.279   | 0.329   | 0.379      |                   |            |
|                   |                                     | Red               | x                              |             |         |         |            |                   |            |
| y                 |                                     |                   |                                |             |         |         |            |                   |            |
| Green             |                                     | x                 |                                |             |         |         |            |                   |            |
|                   |                                     | y                 |                                |             |         |         |            |                   |            |
| Blue              | x                                   |                   |                                |             |         |         |            |                   |            |
|                   | y                                   |                   |                                |             |         |         |            |                   |            |
| chracteristic     |                                     | -                 |                                | -           | 2.2     | -       |            |                   |            |
| Reflective mode   | Viewing angle Range                 | 11/ 12/<br>21/ 22 | CR 2                           | 45          | 55      | -       | ° (degree) | 【Note 9-1】        |            |
|                   | Contrast ratio                      |                   | CR                             | 5           | 8       | -       |            | 【Note 9-6】        |            |
|                   | Response time                       | Rise              | r                              | = 0 °       | -       | (25)    | (50)       | ms                | 【Note 9-3】 |
|                   |                                     | Fall              | d                              |             | -       | (10)    | (30)       | ms                |            |
|                   | Reflection ratio                    |                   | Rf                             |             | 4.4     | 5.5     | -          | %                 | 【Note 9-7】 |
|                   | Whit e chromaticity                 | Whit e            | x                              | = 0 °       | (0.269) | (0.319) | (0.369)    |                   | 【Note 9-8】 |
|                   |                                     |                   | y                              |             | (0.299) | (0.349) | (0.399)    |                   |            |
|                   |                                     | x                 |                                |             |         |         |            |                   |            |
|                   |                                     | y                 |                                |             |         |         |            |                   |            |
|                   |                                     | x                 |                                |             |         |         |            |                   |            |
| y                 |                                     |                   |                                |             |         |         |            |                   |            |
| Lamp Life time    | +25                                 | -                 | continuation                   | 10000       | -       | -       | hour       | 【Note 9-9】        |            |
|                   | -30                                 | -                 | intermission                   | 2000        | -       | -       | time       | 【Note 9-10】       |            |

For the lighting-up evaluation of this backlight unit, it uses an inverter. HIU-359A-W2[Harison Toshiba Lighting Corp.]

measuring after 30minutes operation. It does the optical measurement of the characteristic in the condition which is equal to the darkroom or this using the way of measuring the following figure.

Fig.9-1 Optical characteristics measurement method



Optical characteristics measurement method (Reflection-type mode)

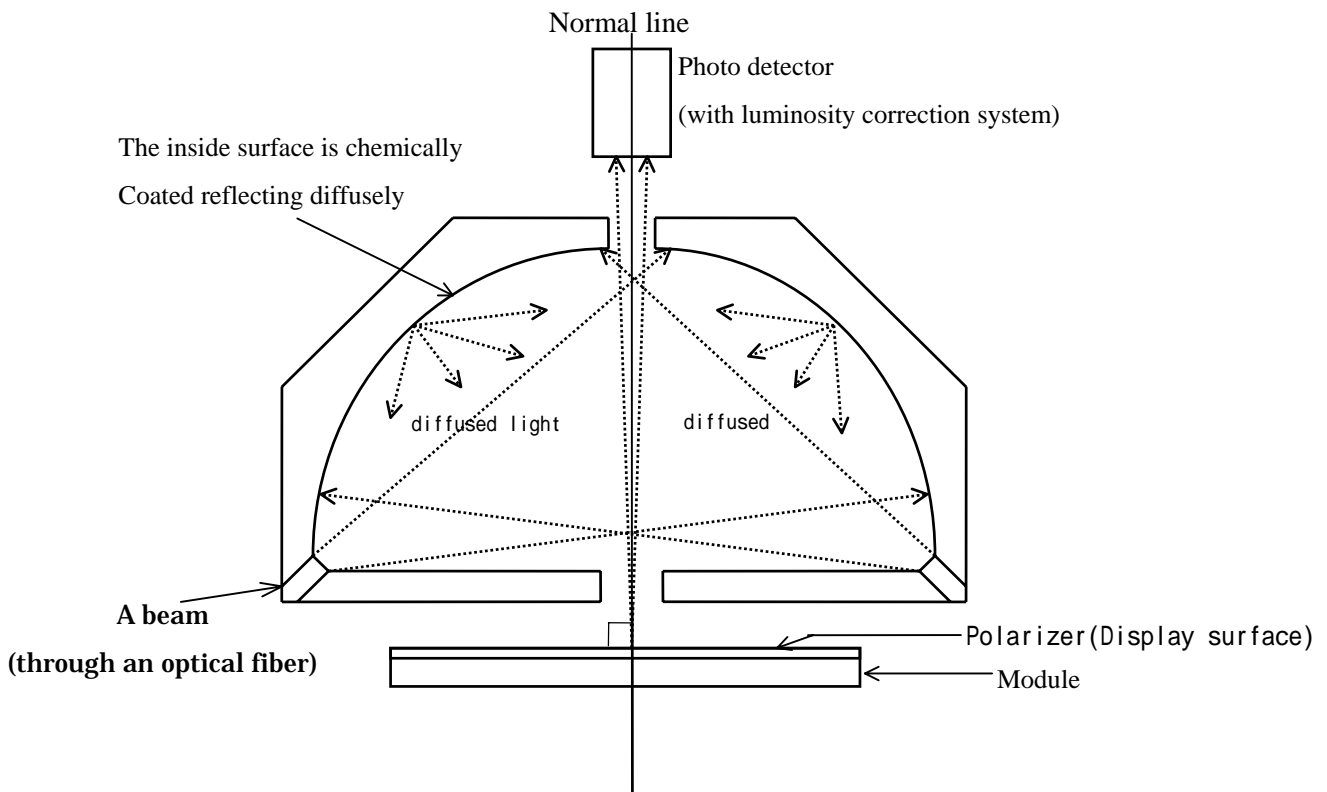
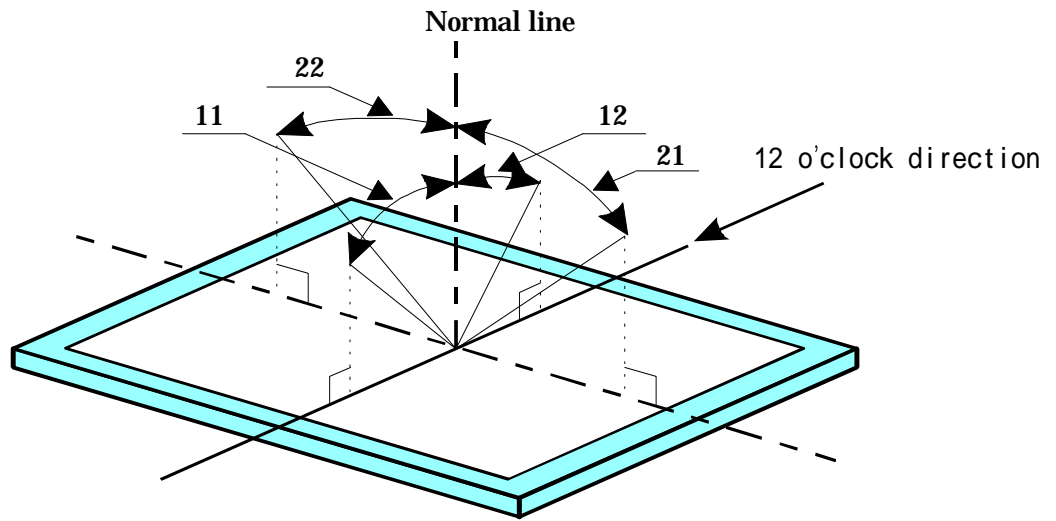


Fig.9-2 Optical characteristics measurement method

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

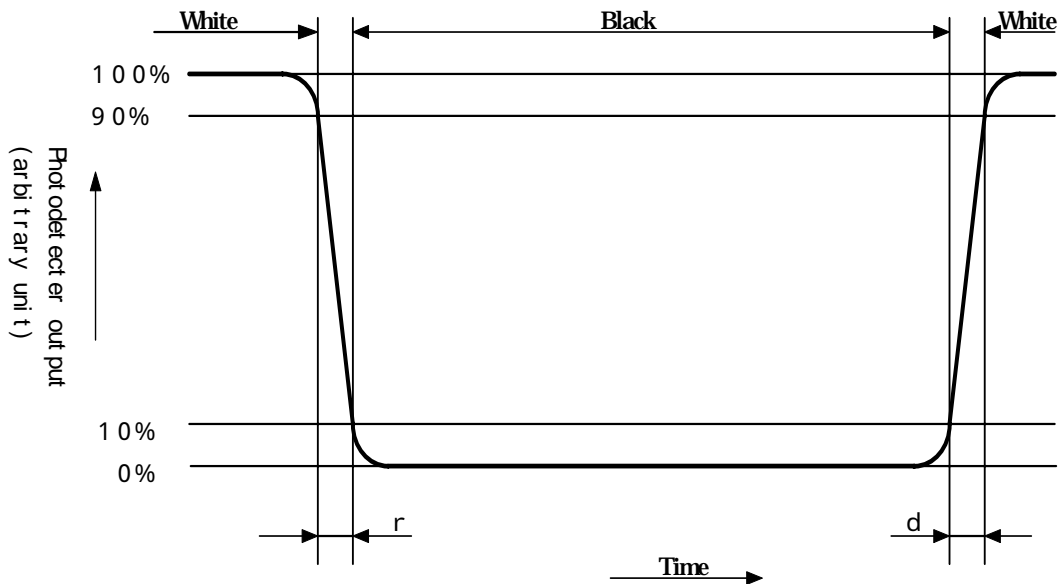


definition for viewing angle

【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 1° by TOPCON luminance meter BM-7.(After 30 minutes operation) DC/AC inverter driving frequency: 49kHz

【Note 9-5】 Relative luminance of lighting after 2 minute at Ta=25 stability of luminance with 100% in surrounding area temperature - 20 .



**【Note 9-6】 Contrast ratio of reflection is defined as follows :**

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output with all pixels white}}{\text{Photo detector output with all pixels black}}$$

**【Note 9-7】 Reflectance is defined as follows:**

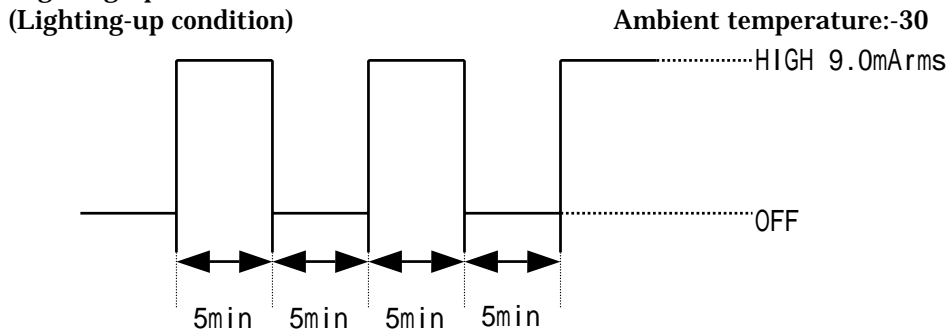
$$\text{Reflection ratio} = \frac{\text{Light detected level of the reflection by the LCD}}{\text{Light detected level of the reflection by the standard}} \times 100$$

**【Note 9-8】** It is assumed that chromaticity of the light source is (x=0.313,y=0.329).

The measuring system is CM-2002 (with the unit reflecting diffusely) made by MINOLTA co.,ltd.

**【Note 9-9】 Lamp life time is defined as the time when either or occurs in the continuous operation under the condition of lamp current IL=6.0 ~ 7.0mA and PWM dimming 100% ~ 5%(Ta=25 °C) Brightness not to become under 50% of the original value.**

**【Note 9-10】 The ON-OFF number of times that the brightness value on the panel surface doesn't become equal to or less than 50% of the brightness value in the early stages in the following lighting-up condition.**



**(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.

**(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.

- a). The noise from the backlight unit will increase.
- b). The output from inverter circuit will be unstable. Then, there may be a possibility that some problems happen.
- c). In some cases, a part of module will heat.
- d). Don't pull a CCFT lead line with the power beyond 10.0N. It has the possibility of the breakage in the lamp, the connection part of the lead line, and so on.
- e). Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury. Please follow local ordinances or regulations for disposal.

**12-2) Precautions in mounting**

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

Protective film (sheet) 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

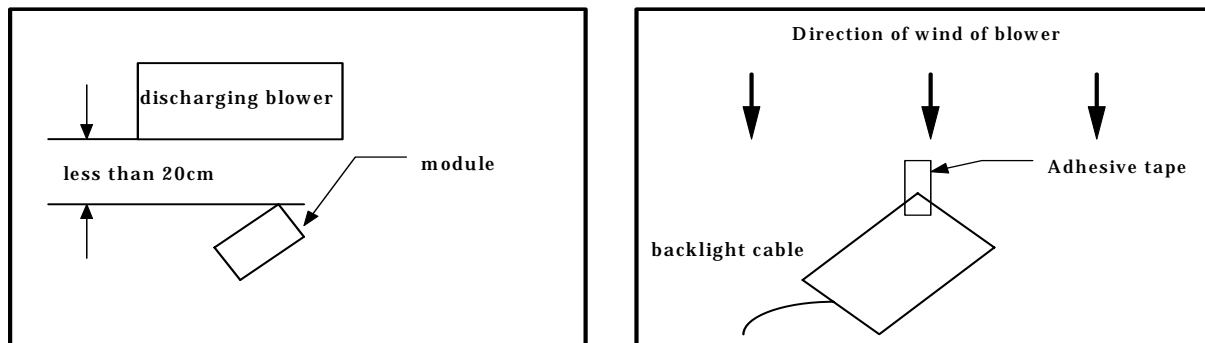
**A) Working environment**

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 1M 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 ~ 27
- 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 several 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 kick off voltage(lamp) may over the normal voltage because of leakage current from approach conductor. 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

- a) Piling number of cartons : MAX 10
- b) Package quantity in one carton 20 pcs
- c) Carton size: 411(W) × 403(H) × 155(D) mm
- d) Total mass of one carton filled with full modules: 5.4 kg
- e) Conditions for storage.

Environment

Temperature : 0 ~ 40

Humidity : 60%RH or less (at 40 )

No dew condensation at low temperature and high humidity.

Atmosphere : Harmful gas, such as acid or alkali which bites electronic components and/or wires, must not be detected.

Period : about 3 months

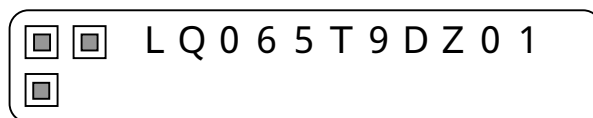
Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

(14) Others

- a) 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.
- b) Disassembling the module can cause permanent damage and should be strictly avoided.
- c) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- d) Indication of lot number

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

Indicated contents of the label



model No.

lot No.

contents of lot No.    the 1st figure    production year    (ex. 2000: 0)  
                                  the 2nd figure    production month    1,2,3,                ,9,X,Y,Z  
                                  the 3rd ~ 7th figure    serial No.    00001 ~  
                                  the 8th figure    revision marks    A,B,C

(15) Reliability Test Conditions for TFT-LCD Module

Table 15-1

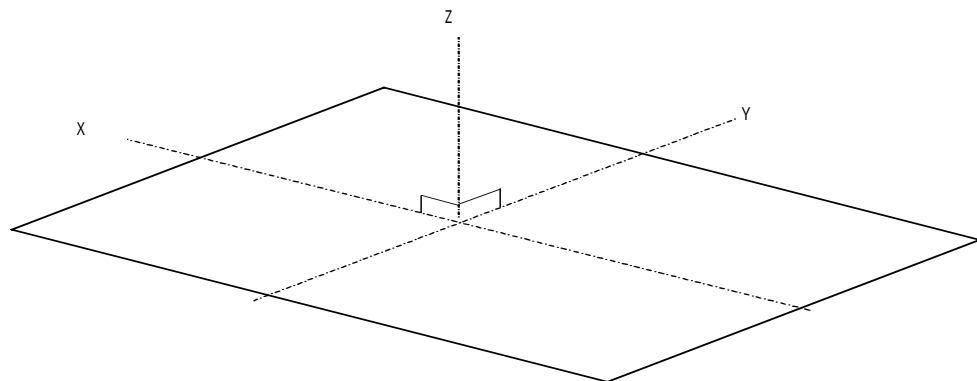
Remark) Temperature condition is based on operating temperature conditions on (5)-Table 5-1.

| No. | Test items  | Test conditions  |
|-----|---|--|
| 1   | High temperature storage test                     | Ta= +85 240h   |
| 2   | High temperature storage test                     | Ta= +95 120h   |
| 3   | Low temperature storage test                      | Ta= -40 240h   |
| 4   | High temperature and high humidity operating test | Tp=+50 95% RH 240h   |
| 5   | High temperature operating test                   | Tp= +85 240h   |
| 6   | Low temperature operating test                    | Ta= -40 240h   |
| 7   | Electro static discharge test                     | ± 200V · 200pF(0 ) 1 time for each terminals   |
| 8   | Shock test  | 980m/s <sup>2</sup> · 6ms, ± X ; ± Y ; ± Z 3 times for each direction ( JIS C0041, A-7 Condition C )   |
| 9   | 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 (total 8 hours) 【caution】<br>( JIS D1601 ) |

【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.

X,Y,Z directions are shown as follows:





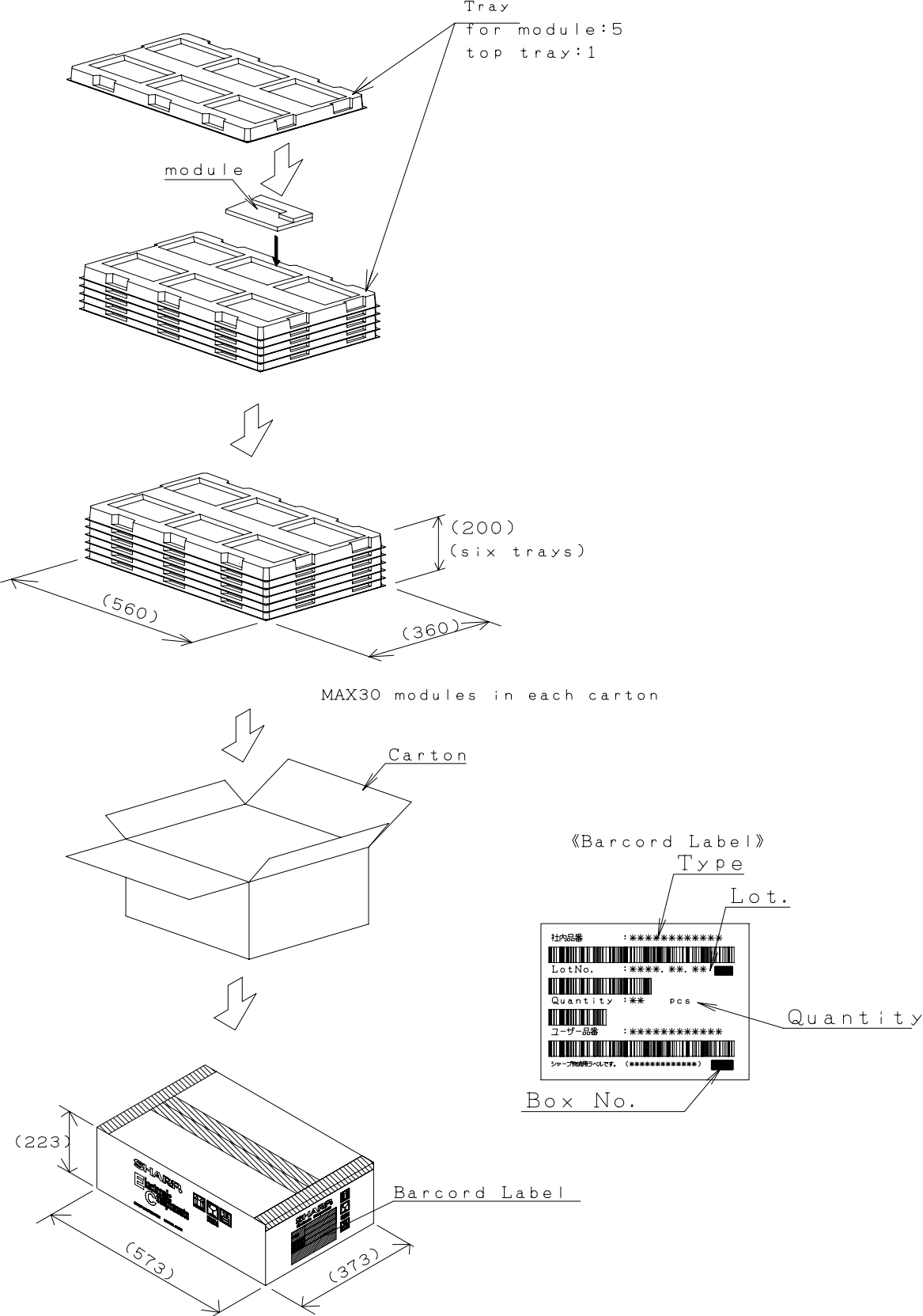


Fig.2 Packing Form