

# SHARP

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| No.  | LCY-11007A |
| DATE | 7.Feb.2011 |

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**TENTATIVE**

TECHNICAL LITERATURE

FOR

TFT - LCD module

MODEL No. LQ042T5DZ11B

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NEW BUSINESS DEVELOPMENT DAPARTMENT  
LCD DIVISION III  
LIQUID CRYSTAL DISPLAY GROUP  
SHARP CORPORATION



## RECORDS OF REVISION

**MODEL No: LQ042T5DZ11B**

[illegible]

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## 1. General

This TFT-LCD module is a color active matrix LCD (Liquid Crystal Display) module of transmissive type incorporating amorphous silicon TFT (Thin Film Transistor). General specification of the module is shown in the Table 3-1.

It is composed of a color TFT-LCD panel, driver ICs, control-PWB, FPC(between color TFT-LCD panel and control-PWB), frame, shielding front case, shielding back case and backlight unit.

## 2. Features

- Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide-screen systems.
- The 4.2 screen produces a high resolution image that is composed of 130,560 pixels elements in a stripe arrangement.
- Graphics and texts can be displayed on a 480 x 272 x RGB dots panel with 262,144 colors by supplying 18 bits (6 bits×RGB) data signal.
- Wide viewing field angle technology is employed.
- By adopting an active matrix drive, a picture with high contrast is realized.
- By COG method, realized a slim, lightweight, and compact module.
- Reduced reflection as a result of low reflection black matrix and an antiglare (AG) and anti-reflection (AR) polarizer being adopted.
- Realized a high quality picture of the natural color appearance by adopting Normally Black Mode which is superior to the color appearance.
- An inverted video display in the vertical and horizontal directions is possible.
- The backlight is excellent of brightness rising characteristics at low temperature in consideration of automotive application.

## 3. Mechanical specifications (Dot Composition)

General Specification of the Module Table 3-1

| Parameter              | Specifications              | Units  | Remarks    |
|------------------------|-----------------------------|--------|------------|
| Display format         | 130,560                     | pixels |            |
|                        | 480(W)×272(H)×RGB           | dots   |            |
| Active area            | 92.88 (W) × 52.632 (H)      | mm     |            |
| Screen size (Diagonal) | 10.68[4.20 “]               | cm     |            |
| Dot pitch              | 0.1935 (W) × 0.0645 (H)     | mm     |            |
| Pixel configuration    | R,G,B Stripe configuration  |        |            |
| Outline dimension      | 102.5 (W)×69.0 (H)×12.0 (D) | mm     | [Note 3-1] |
| Mass                   | 120 (Typ.)                  | g      |            |

[Note 3-1]

Excluding protrusions. Typical values are given.

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

## 4. Input terminal and its function

## 4-1 TFT-LCD panel driving part

Connector used : FH41-50S-0.5SH(05)  
(HRS)

Table 4-1

| Pin No. | Symbol | Description                                  | Remarks   |
|---------|--------|--|-----------|
| 1       | TEST   | Continuity to Pin 50                         |           |
| 2       | GND    | GND  |           |
| 3       | N.C.   | OPEN   |           |
| 4       | B+     | Power Supply Voltage for Backlight           |           |
| 5       | B+     | Power Supply Voltage for Backlight           |           |
| 6       | N.C.   | OPEN   |           |
| 7       | GND    | GND  |           |
| 8       | GND    | GND  |           |
| 9       | BL_PWM | Input Signal for Backlight Dimming           |           |
| 10      | N.C.   | OPEN   |           |
| 11      | THM1   | Thermistor                                   | [Note4-5] |
| 12      | THM2   | Thermistor                                   | [Note4-5] |
| 13      | VRV    | Turning the Direction of Vertical Scanning   | [Note4-4] |
| 14      | HRV    | Turning the Direction of Horizontal Scanning | [Note4-3] |
| 15      | GND    | Logic GND                                    |           |
| 16      | N.C.   | OPEN   |           |
| 17      | VCC    | Power Supply Voltage                         |           |
| 18      | VCC    | Power Supply Voltage                         |           |
| 19      | N.C.   | OPEN   |           |
| 20      | GND    | GND  |           |
| 21      | R5     | Red Data Signal(MSB)                         |           |
| 22      | R4     | Red Data Signal                              |           |
| 23      | R3     | Red Data Signal                              |           |
| 24      | R2     | Red Data Signal                              |           |
| 25      | R1     | Red Data Signal                              |           |
| 26      | R0     | Red Data Signal(LSB)                         |           |
| 27      | GND    | GND  |           |
| 28      | G5     | Green Data Signal(MSB)                       |           |
| 29      | G4     | Green Data Signal                            |           |
| 30      | G3     | Green Data Signal                            |           |
| 31      | G2     | Green Data Signal                            |           |
| 32      | G1     | Green Data Signal                            |           |
| 33      | G0     | Green Data Signal(LSB)                       |           |
| 34      | GND    | GND  |           |
| 35      | B5     | Blue Data Signal(MSB)                        |           |
| 36      | B4     | Blue Data Signal                             |           |
| 37      | B3     | Blue Data Signal                             |           |
| 38      | B2     | Blue Data Signal                             |           |
| 39      | B1     | Blue Data Signal                             |           |
| 40      | B0     | Blue Data Signal(LSB)                        |           |
| 41      | GND    | GND  |           |
| 42      | PON    | Reset Signal                                 |           |
| 43      | GND    | GND  |           |
| 44      | NCLK   | Clock Signal for Sampling Each Data Signal   |           |
| 45      | GND    | GND  |           |

| Pin No. | Symbol | Description            | Remarks   |
|---------|--------|------------------------|-----------|
| 46      | VD     | Vertical Sync          | [Note4-1] |
| 47      | DEN    | Horizontal Data Enable | [Note4-2] |
| 48      | HD     | Horizontal Sync        | [Note4-1] |
| 49      | GND    | GND                    |           |
| 50      | TEST   | Continuity to Pin 1    |           |

[Note4-1]

|       |                   |
|-------|-------------------|
| Hsync | Negative polarity |
| Vsync | Negative polarity |

[Note4-2] The horizontal display starting position is settled in accordance with a rising timing of DEN signal. (Refer to Fig.4)

In case DEN is fixed to "Low", the horizontal display starting position is determined as described in Fig.4.(Don't keep DataEn "High" during operation.)

[Note4-3]

HRV="Hi" : Regular video

HRV="Lo" : Horizontally inverted video

[Note4-4]

VRV="Hi" : Regular video

VRV="Lo" : Vertically inverted video

[Note4-5]

Thermistor parts number : NSM2103F344F3 (OHIZUMI)

## 5. Absolute maximum ratings

Table 5-1

GND=0V

| Parameter  | Symbol            | M I N | M A X                | Unit | Note             |
|--|-------------------|-------|----------------------|------|------------------|
| Input voltage  | VB+               | -0.3  | 21                   |      |                  |
| +3.3V power supply                                     | V <sub>cc</sub>   | -0.3  | +4.0                 | V    |                  |
| Input signal voltage 1                                 | Vi1               | -0.3  | V <sub>cc</sub> +0.3 | V    | [Note 5-1]       |
| Input signal voltage 2                                 | Vi2               | -0.3  | "VB+" +0.3           | V    | [Note 5-2]       |
| Storage temperature                                    | T <sub>stg</sub>  | -40   | 85                   | °C   | [Note 5-3.4]     |
| Operating temperature<br>(panel surface : active area) | T <sub>opr1</sub> | -30   | 85                   | °C   | [Note 5-3,4,5,6] |
| Operating temperature<br>(Ambient temperature)         | T <sub>opr2</sub> | -40   | 85                   | °C   | [Note 5-6]       |

[Note 5-1] HD , DEN , VD , NCLK , B0~B5 , G0~G5 , R0~R5 , HRV , VRV , PON

[Note 5-2] BL\_PWM

[Note 5-3] This rating applies to all parts of the module and should not be exceeded.

The specified temperature provides the maximum value within 5mm around the module.

[Note 5-4] Maximum wet-bulb temperature is to be less than 58°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

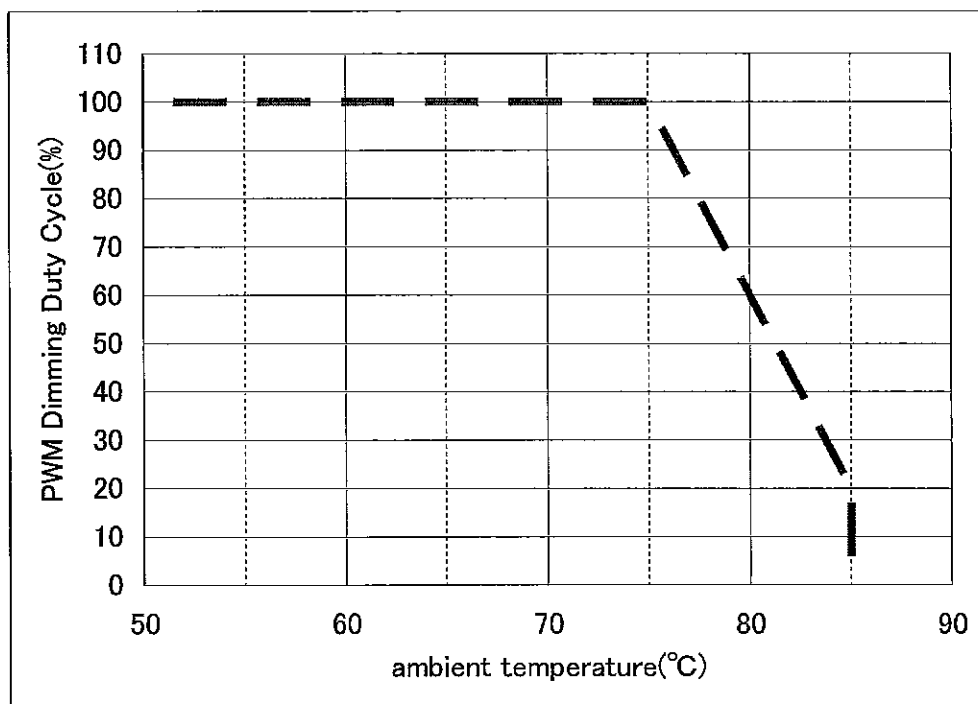
[Note 5-5] The operating temperature only guarantees operation of the circuit. Specifications (contrast ratio, response time and other factors related to display quality) are determining at ambient temperature (T<sub>a</sub>=25°C) .

[Note 5-6] Ambient temperature when the backlight is lit. (by PWM).

PWM dimming shall operate at T<sub>a</sub> ≥ 75°C. (See attached figure)

(Do not allow thermistor value to fall below 1.4kΩ)

Countermeasures for heat generation from LCD module are required at customer's system.



[Note 5-7] The above graph is reference data as LCD module alone

## 6. Electrical characteristics

### 6-1 TFT-LCD panel driving section

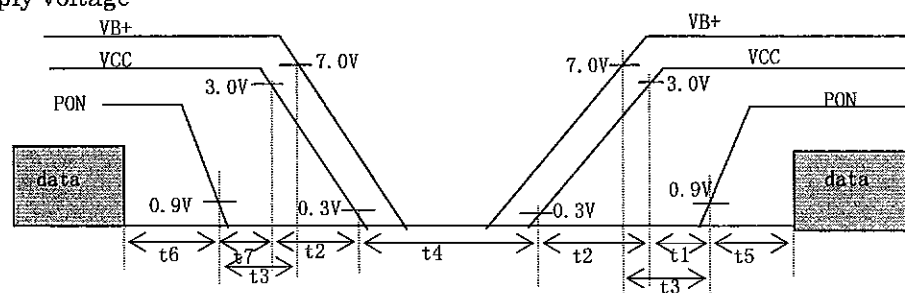
Table 6-1

| Parameter               |                     | Symbol           | M I N              | T Y P | M A X              | Unit | Remarks   |
|-------------------------|---------------------|------------------|--------------------|-------|--------------------|------|---|
| B+                      | Supply voltage      | VB+              | 7.0                | 13.5  | 18.0               | V    | [Note 6-1]  |
|                         | Current dissipation | IB+              | —                  | 150   | 400                | mA   | MAX:VB+=7.0V  |
| Input Low voltage       |                     | V <sub>IBL</sub> | GND                | —     | 0.4                | V    | “BL_PWM” terminal                                       |
| Input High voltage      |                     | V <sub>IBH</sub> | 2.1                | —     | 5.5                | V    |   |
| VCC                     | Supply voltage      | V <sub>CC</sub>  | +3.0               | +3.3  | +3.6               | V    | [Note 6-1]  |
|                         | Current dissipation | I <sub>CC</sub>  | —                  | 15    | 45                 | mA   | [Note 6-2]  |
| Permissive input ripple |                     | V <sub>RF</sub>  | —                  | —     | 100                | mVpp |   |
| Input Low voltage       |                     | V <sub>IL</sub>  | GND                | —     | 0.3V <sub>CC</sub> | V    | [Note 6-3]  |
| Input High voltage      |                     | V <sub>IH</sub>  | 0.7V <sub>CC</sub> | —     | V <sub>CC</sub>    | V    |   |
| Input current 1 (Low)   |                     | I <sub>IL1</sub> | -1.0               | —     | —                  | μA   | V <sub>I</sub> =0V or V <sub>CC</sub><br>[Note 6-4]     |
| Input current 1 (High)  |                     | I <sub>IH1</sub> | —                  | —     | 1.0                | μA   |   |
| Input current 2 (Low)   |                     | I <sub>IL2</sub> | -30.0              | —     | —                  | μA   | V <sub>I</sub> =0V or V <sub>CC</sub><br>[Note 6-5]     |
| Input current 2 (High)  |                     | I <sub>IH2</sub> | —                  | —     | 1.0                | μA   |   |
| Input current 3 (Low)   |                     | I <sub>IL3</sub> | -2.0               | —     | —                  | μA   | V <sub>I</sub> =0V or V <sub>CC</sub><br>“PON” terminal |
| Input current 3 (High)  |                     | I <sub>IH3</sub> | —                  | —     | 2.0                | μA   |   |
| Input current 4 (Low)   |                     | I <sub>IL5</sub> | —                  | —     | 1.0                | μA   | V <sub>IB</sub> =0V or 5.5V<br>“BL_PWM” terminal        |
| Input current 4 (High)  |                     | I <sub>IH5</sub> | —                  | —     | 600                | μA   |   |

[Note 6-1]

On-off conditions for supply voltage

- $0 < t_1$   
 $0 < t_2 \leq 10\text{ms}$   
 $0 < t_3$   
 $t_4 \geq 1\text{s}$   
 $0 < t_5 \leq 10\text{ms}$   
 $t_6 \leq 10\text{ms}$   
 $0 \leq t_7$



\*When PON signal turns off, display pattern may be un-controlled for an instance.

\*data = HD , DEN , VD , NCLK , B0~B5 , G0~G5 , R0~R5 , HRV , VRV , BL\_PWM

[Note 6-2]

Typical current situation: White (GS63) pattern

Timing: Typical

VCC= +3.3 V

[Note 6-3]

HD , DEN , VD , NCLK , B0~B5 , G0~G5 , R0~R5 , HRV , VRV , PON

[Note 6-4]

NCLK , B0~B5 , G0~G5 , R0~R5

[Note 6-4]

HD , VD , DEN , HRV , VRV



## 7. Timing Characteristics of input signals

### 7-1) Timing characteristics

Table 7-1

| Parameter                         |             | Symbol  | Min. | Typ. | Max.  | Unit | Note                        |
|-----------------------------------|-------------|---------|------|------|-------|------|-----------------------------|
| Clock<br>[NCLK]                   | Frequency   | fCLK    | 8.58 | 9.70 | 10.99 | MHz  |                             |
|                                   | Hi_Time     | tWCH    | 20   | —    | —     | ns   |                             |
|                                   | Lo_Time     | tWCL    | 20   | —    | —     | ns   |                             |
| Data<br>[I* 0-5]                  | Setup time  | tDS     | 10   | —    | —     | ns   |                             |
|                                   | Hold time   | tDH     | 10   | —    | —     | ns   |                             |
| Horizontal<br>sync.signal<br>[HD] | Cycle       | tH(t)   | 54.5 | 64.1 | 65.5  | μs   |                             |
|                                   |             | tH(clk) | 598  | 622  | 646   | ck   |                             |
|                                   | Pulse width | tHPW    | 5    | —    | TH-5  | ck   |                             |
| Vertical sync.<br>Signal [VD]     | Cycle       | tV      | 305  | 312  | 344   | line |                             |
|                                   | Pulse width | tVPW    | 2    | —    | TV-2  | line |                             |
| Frame rate                        |             | fV      | 50   | 50   | 60    | Hz   |                             |
| Horizontal display period         |             | tHA     | 480  |      |       | ck   | Only 480 ck                 |
| HD_NCLK phase difference          |             | tHC     | A-8  | A    | A+8   | ns   | A=1 / 2fCLK                 |
| HD_VD phase difference            |             | tVH     | -10  | —    | 10    | ck   |                             |
| Vertical front porch              |             | tVFP    | 2    | —    | —     | line |                             |
| Vertical back porch               |             | tVBP    | 31   |      |       | line | Only 31 line                |
| Vertical display period           |             | tVA     | 272  |      |       | line | Only 272 line               |
| Enable signal<br>[HENAB]          | Setup time  | tES     | 10   | —    | —     | ns   | [Note 7-1]                  |
|                                   | Hold time   | tEH     | 10   | —    | —     | ns   |                             |
|                                   | Pulse width | tEP     | 480  |      |       | ck   | [Note 7-1]<br>Only 480 line |
| Horizontal front porch            |             | tHFP    | 2    | —    | —     | ck   |                             |
| Horizontal back porch             |             | tHBP    | 116  |      |       | ck   | [Note 7-2]<br>Only 116 ck   |
|                                   |             |         | 20   | —    | 164   | ck   | [Note 7-3]                  |
| PWM Dimming Frequency             |             | fpwm    | 150  | —    | 250   | Hz   | BL_PWM<br>[Note 7-4]        |
| PWM Dimming Duty Cycle            |             |         | 1.0  | —    | 100   | %    |                             |

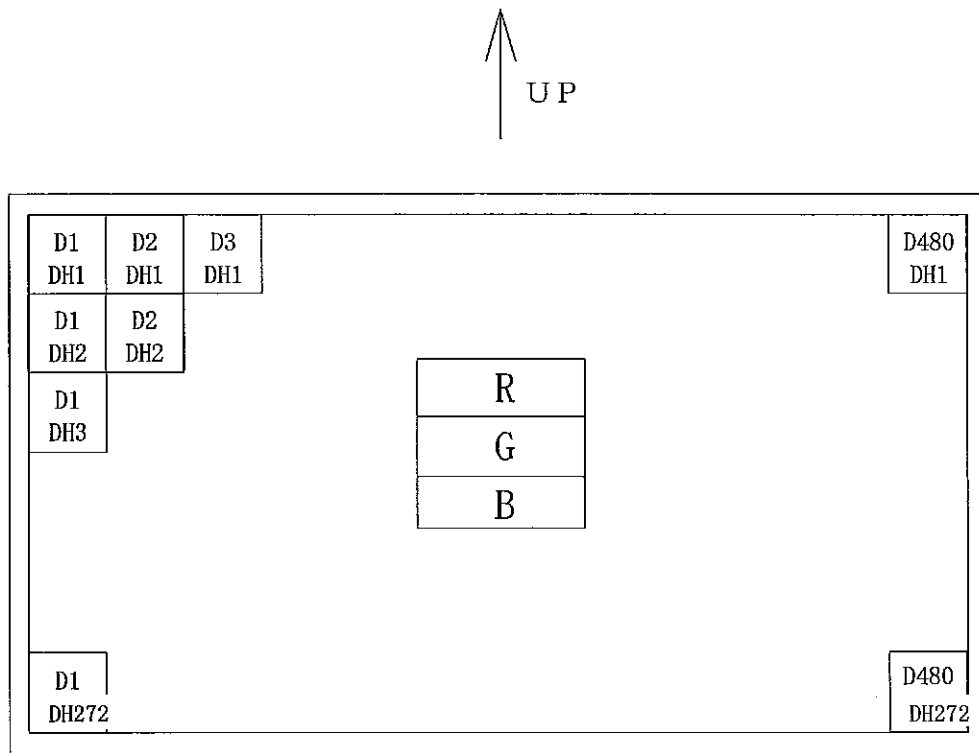
[Note 7-1] Enable signal must be input into Vertical invalid data period as well as Vertical display period.

[Note 7-2] This spec is applied for DEN Low fix mode.

[Note 7-3] This spec is applied for DEN active mode.

[Note 7-4] PWM Dimming Minimum OFF Pulse-Wide is 400ns. (at LCD module connector)

7-2) Input Data Signals and Display Position on the screen  
Refer to the following figure



Display position of input data (H,V)

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

Table 8-1

| Table 3-1              |          |                      |    |    |    |    |    |    |    |                       |    |    |    |    |    |    |    |    |    |    |
|------------------------|----------|----------------------|----|----|----|----|----|----|----|-----------------------|----|----|----|----|----|----|----|----|----|----|
| Colors &<br>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  |
|                        | Darker   | GS1                  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0                     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                        |          | 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  |
|                        | Darker   | GS1                  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0                     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                        |          | 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  |
|                        | Darker   | GS1                  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0                     | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  |
|                        |          | 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 by 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

## 9. Optical characteristics

Table 9-1

Ta=25°C , Vcc=+3.3V , VB+=13.5V , BL\_PWM=100% ,Initial Value

| Parameter           | Symbol                   | Condition          | Min   | Typ.  | Max   | Unit              | Remarks   |
|---------------------|--------------------------|--------------------|-------|-------|-------|-------------------|-----------|
| Viewing Angle Range | $\theta$ 21, $\theta$ 22 | CR=>10             | 70    | 85    | —     | ° (degree)        | [Note9-1] |
|                     | $\theta$ 11, $\theta$ 12 |                    | 70    | 85    | —     | ° (degree)        |           |
| Contrast ratio      | C R max                  | $\theta = 0^\circ$ | 1100  | 1600  | —     |                   | [Note9-2] |
| Response time       | Rise                     |                    | —     | 15    | 35    | ms                | [Note9-3] |
|                     | Fall                     |                    | —     | 5     | 15    | ms                |           |
| Color Chromaticity  | x (white)                |                    | 0.240 | 0.290 | 0.340 |                   |           |
|                     | y (white)                |                    | 0.270 | 0.320 | 0.370 |                   |           |
|                     | x (red)                  |                    | 0.572 | 0.622 | 0.672 |                   |           |
|                     | y (red)                  |                    | 0.298 | 0.348 | 0.398 |                   |           |
|                     | x (green)                |                    | 0.270 | 0.320 | 0.370 |                   |           |
|                     | y (green)                |                    | 0.565 | 0.615 | 0.665 |                   |           |
|                     | x (blue)                 |                    | 0.100 | 0.150 | 0.200 |                   |           |
|                     | y (blue)                 |                    | 0.040 | 0.090 | 0.140 |                   |           |
| Luminance           | Y                        |                    | 375   | 500   | —     | cd/m <sup>2</sup> |           |

※Measured after 30 minutes operation. The optical characteristic is measured by using the method of fig.6 and fig.7 under the condition of the darkroom or equivalent to it.

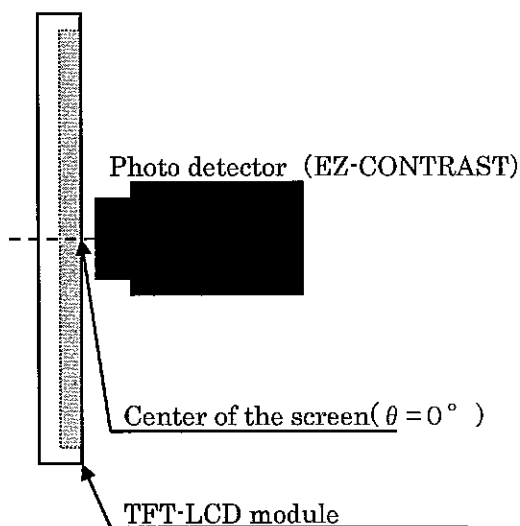


Fig. 6 The way of measuring  
Off-Axis Half Brightness/  
Viewing angle range/  
Response time

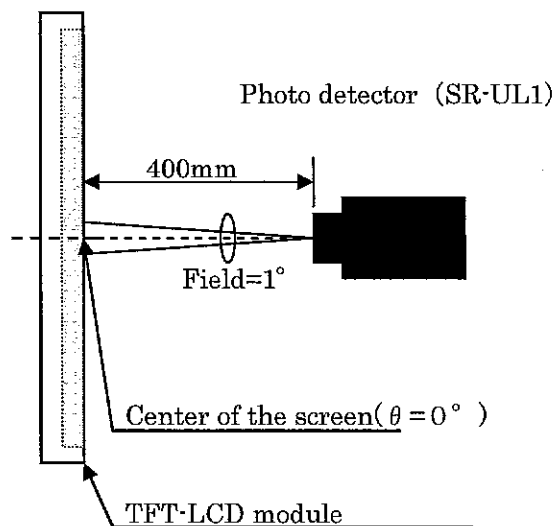
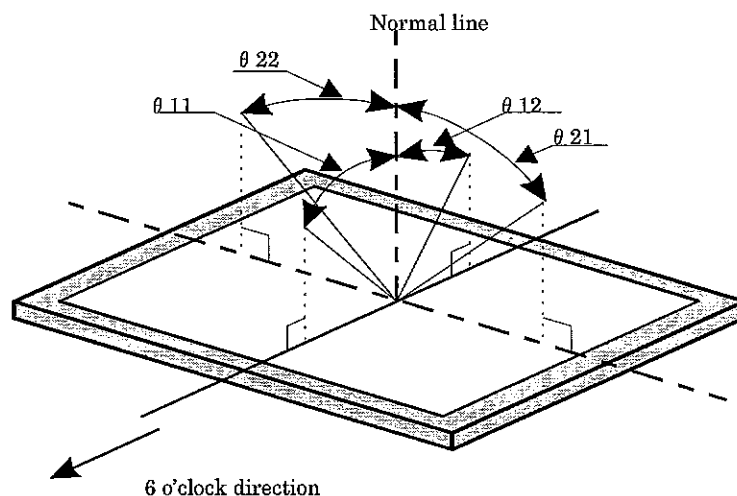


Fig. 7 The way of measuring  
Contrast/ Luminance/ Chromaticity

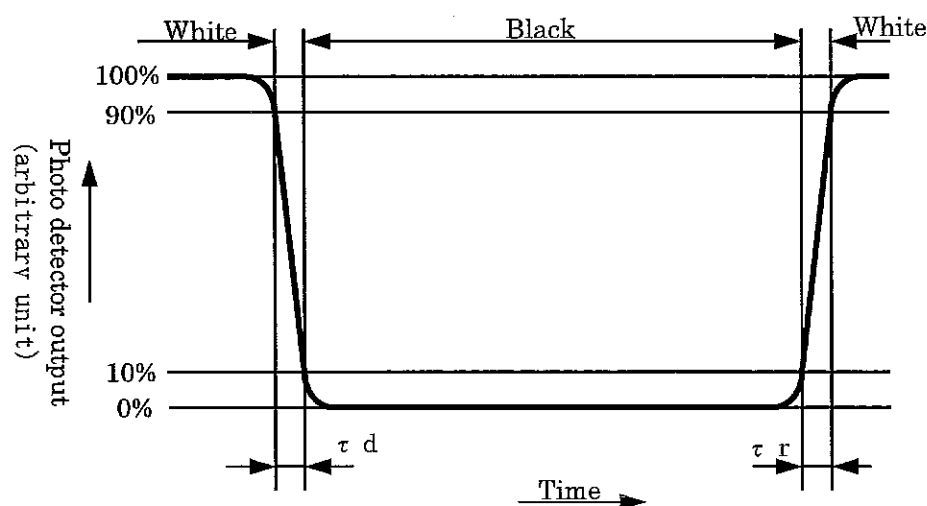
[Note 9-1] Viewing Angle Range and Off-Axis Half Brightness are defined as follows.



[Note 9-2] Contrast ratio of transmission 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".



**10. Display quality**

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

**11. Mechanical characteristics****11-1 External appearance**

No extreme defect exists. (See Fig. 1)

**11-2 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.

**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 2.5 tapping screw (fastening torque is TYP 0.4N·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.

Power off the module, when you connect the input/output connector.

Please ensure that the LCD metal case is grounded in the system design.

**12-2 Precautions in mounting**

①Polarizer which is made of soft material and susceptible to flaw must be handled carefully.

Protection sheet is applied on the surface to protect it against scratches and dirties.

It is recommended to remove the protection sheet immediately before the use, taking care of static electricity.

The protection seat removed from the module doesn't assure quality.

②Precautions in removing the protection sheet

**A) Working environment**

When the protection sheet is removed off, static electricity may cause dust to stick to the polarizer surface.

To avoid this, the following working environment is desirable.

a) Floor: Conductive treatment of  $1\text{M}\Omega$  or more on the tile  
(conductive mat or conductive paint on the tile)

b) Clean room free from dust and with an adhesive mat on the doorway

c) Advisable humidity:50%~70%      Advisable temperature:15°C~27°C

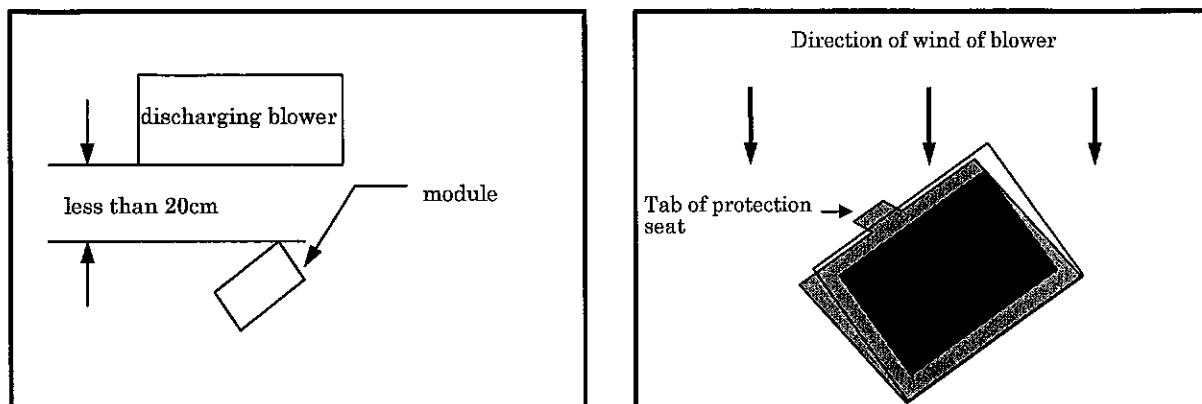
d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

**B) Working procedures**

a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm.

b) Remove the protection sheet, pulling the tab of protection seat slowly to your side.

c) On removing the protection sheet, 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 N2 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, to use adhesive tape is recommended to remove them softly 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 Caution of product design

The LCD module shall be protected against water or salt-water by the waterproof cover. Take measures against the interferential radiation from module, not to interfere surrounding appliances.

### 12-4 Others

1. Liquid crystal is sensitive to ultraviolet rays.  
Do not expose the module to direct sunlight for a long time.
2. Storage of the module under temperatures lower than the specified range may solidify liquid crystal in the module, resulting in damage to the panel. Storage of the module under temperatures exceeding the specified range may cause an irreversible change of liquid crystal to the isotropic phase.
3. When the LCD is broken, take care not to mouth liquid crystal. When liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.
4. Remove any water droplets or dirt on the polarizer without delay.  
Failure to do so may cause degradation.
5. Observe all other precautionary requirements in handling general electronic components.
6. When it keeps pushing a part of the touch panel for a long time, it causes the generation of Newton rings.
7. The LCD has been calibrated prior to shipment, do not change any of the adjustable values within the LCD module.
8. Be careful when using it for long time with fixed pattern display as it may cause accidental image.
9. Never take to pieces the module, because it will cause failure.  
Please do not peel off the Black tape pasted to the product.

**13. Packing form**

13-1) The packing form figure: See Fig.3

- ①Piling number of cartons : MAX 9
- ②Package quantity in one carton (pcs) : 80
- ③Carton size (mm) : 624 (W)×419(H)×196 (D)
- ④Total mass of one carton (kg) : 12.6

13-2) Conditions for storage

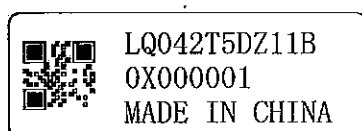
**Environment**

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

**14. Others**

14-1) Indication of lot number

- ①Attached location of the label : See Fig.1 (Outline Dimensions).
- ②Indicated contents of the label



- ← model number
- ← lot number

contents of lot No.

- the 1st figure ·· production year (ex. 2009: 9)
- the 2nd figure ·· production month 1,2,3,·····,9,X,Y,Z
- the 3rd~8th figure ·· serial No. 000001~
- the 9th figure ·· revision marks A,B,C··



## 15. Reliability Test Conditions for TFT-LCD Module

Table 15-1

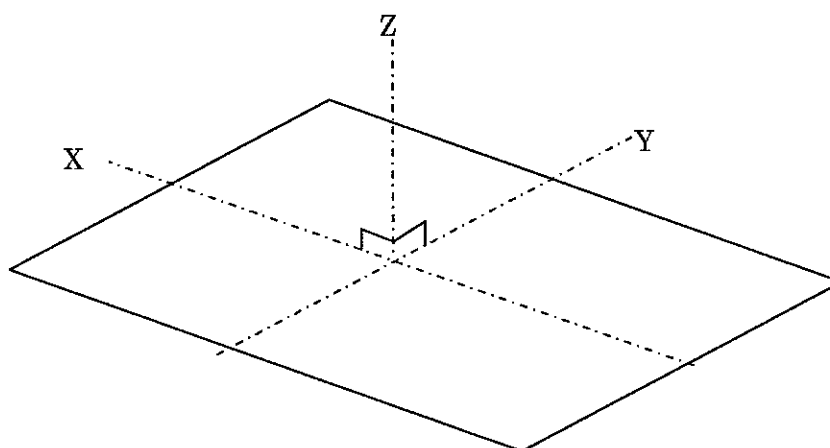
Remark) Temperature condition is based on operating temperature conditions on 5-Table 5-1.

| No. | Test items  | Test conditions  |                           |
|-----|---|--|---------------------------|
| 1   | High temperature Storage test                     | Ta= +85°C  | 240h                      |
| 2   | Low temperature Storage test                      | Ta= -30°C  | 240h                      |
| 3   | High temperature and high humidity operating test | Tp=+60°C 90%RH   | 240h                      |
| 4   | High temperature operating test                   | Tp= +75°C  | 240h                      |
| 5   | Low temperature operating test                    | Ta= -30°C  | 240h                      |
| 6   | Electro static discharge test                     | $\pm 200\text{V} \cdot 200\text{pF}(0\Omega)$  | 1 time for each terminals |
| 7   | Shock test  | 980m/s <sup>2</sup> · 6ms, $\pm X$ ; $\pm Y$ ; $\pm Z$<br>3 times for each direction<br>(JIS C0041, A-7 Condition C)   |                           |
| 8   | Vibration test                                    | Frequency range : 8~33.3Hz, Stroke : 1.3mm<br>Frequency range : 33.3Hz~400Hz, Acceleration : 29.4m/s <sup>2</sup><br>Sweep cycle : 15 minutes<br>X,Z 2 hours for each directions, 4 hours for Y direction<br>【caution】 (total 8 hours) (JIS D1601) |                           |
| 9   | Heat shock test                                   | Ta= -30°C ~ +85°C / 200 cycles<br>(0.5h) (0.5h)  |                           |

【Note】 Ta= Ambient temperature, Tp= Panel temperature(Active area)

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

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





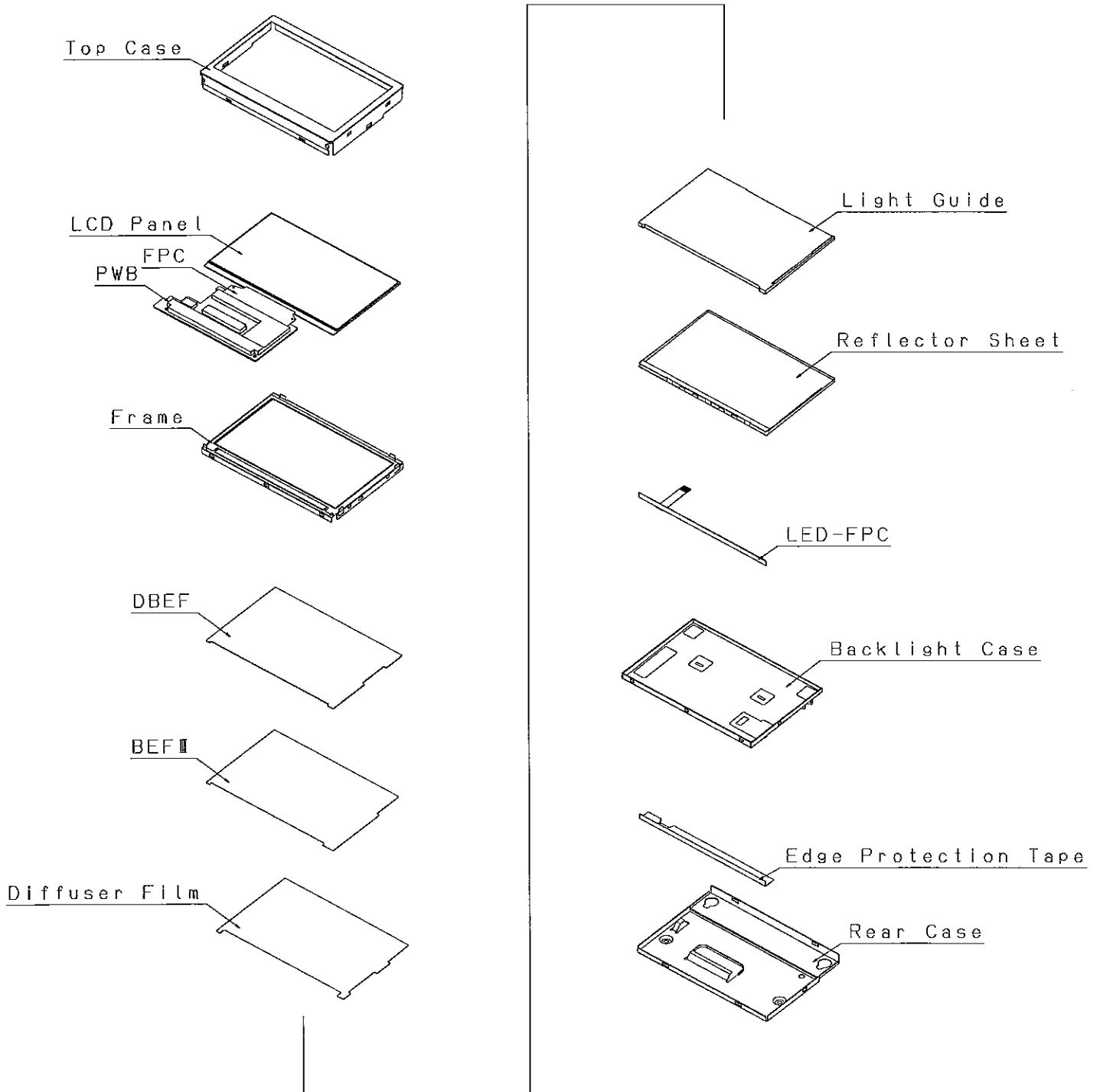


Fig.2 Assembly Diagram

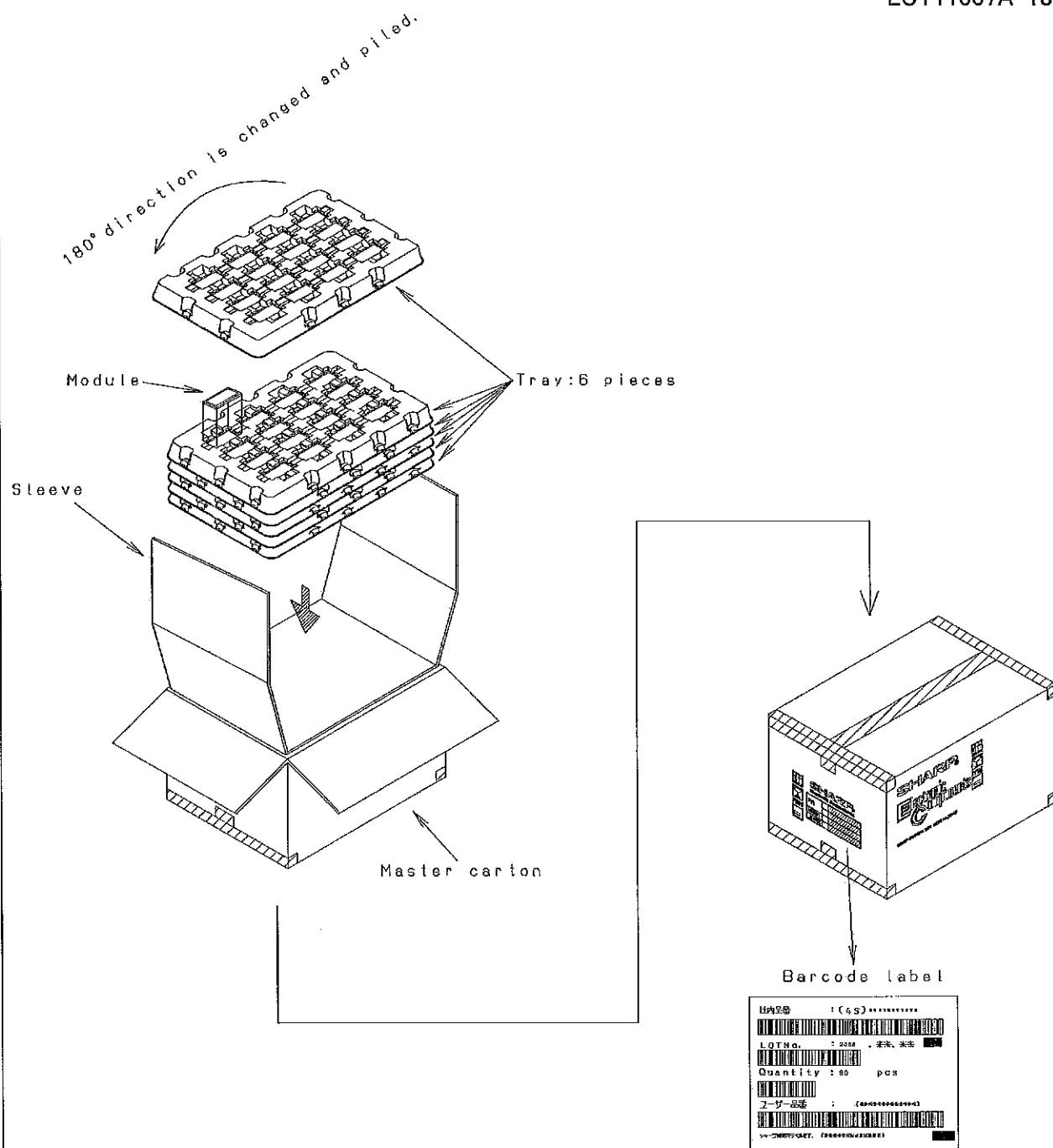


Fig.3 Packing Form

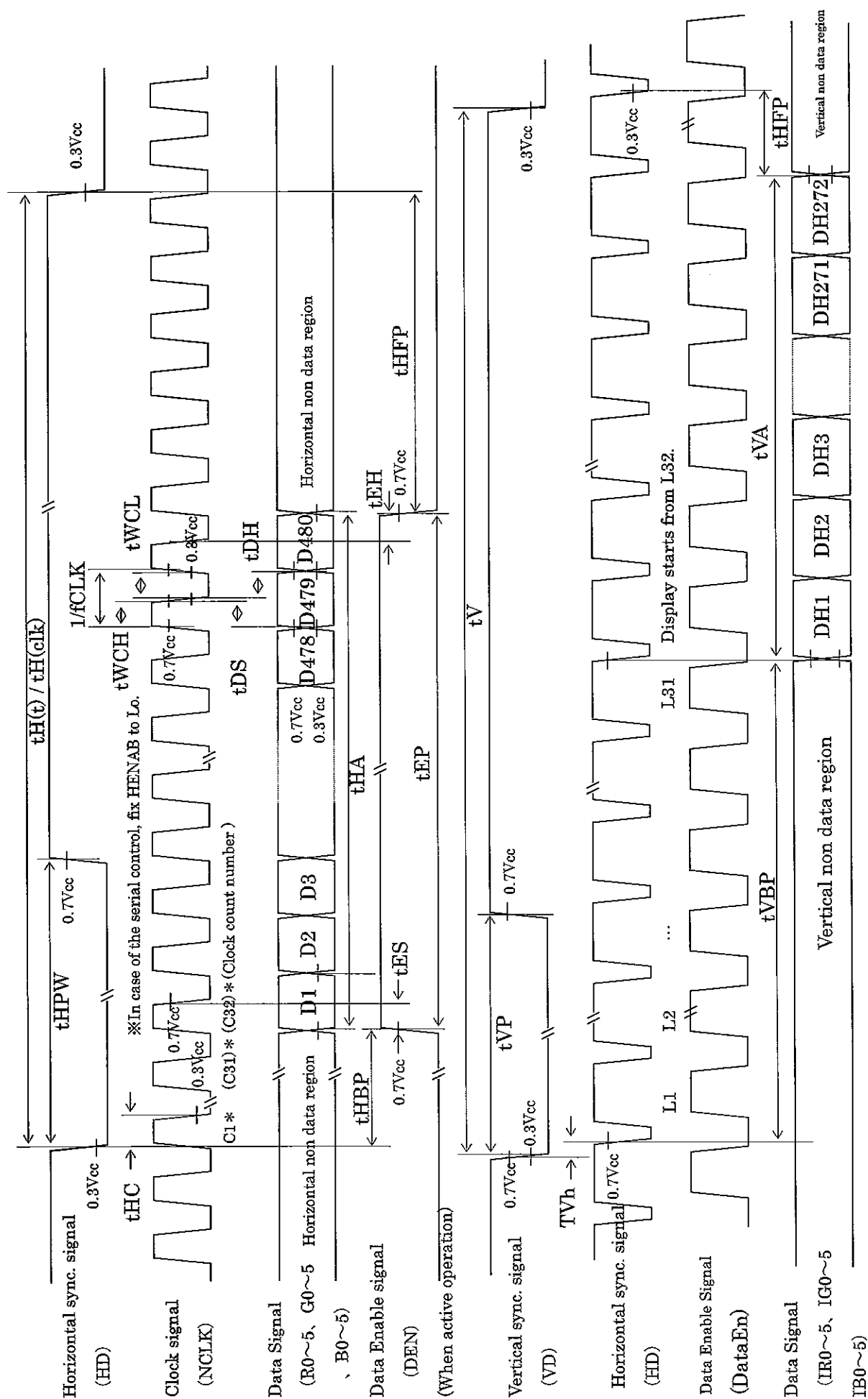


Fig. 4: Input signal timing chart