SPEC No. LD-6501E

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EXT: 146

DEVICE SPECIFICATION FOR

# TFT-LCD Module

MODEL No.

# LQ10D031

☐ CUSTOMER'S APPROVAL

DATE

BY

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# RECORDS OF REVISION

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LD-6501 | — | — | | — | 1st Issue |
| LD-6501A | JUN. 29. 1994 | A | 1 | 3. Mechanical Specifications | 2nd Issue |
| | | | | (Haze) (25±5) | (Added) |
| | | | 2 | 4-1)TFT-LCD panel driving | |
| | | | | 【Note2】 | (Added) |
| | | | | 【Note1】 | (Added) |
| | | | 3 | 4-1)TFT-LCD panel driving | |
| | | | | Fig | (Added) |
| | | | | 4-2)Backlight driving | |
| | | | | CN A Pin2 | (Added) |
| | | | 4 | In sheet LD6601-4. appended the last | |
| | | | | lines. | (Added) |
| | | | 5 | 7-1. Timing characteristics | |
| | | | | Frequency(clock) | |
| | | | | Max. 31.50(MHz) → 28.33(MHz) | (Changed) |
| | | | | 7-2. Horizontal display position and | |
| | | | | Data enable signal. | |
| | | | | · Hsync-Enable signal phase difference | |
| | | | | Min. 84(clock) → 44(clock) | |
| | | | | Max. 204(clock) → 164(clock) | (Changed) |
| | | | 6~8 | Fig. 2-①~⑩ Input signal waveforms | |
| | | | | TTL level → C-MOS level | (Changed) |
| | | | 11 | Fig. 3 BM-5 → BM-5A | (Changed) |
| | | | 14 | 14. Others | |
| | | | | 4) | (Added) |
| LD-6501B | SEP. 1. 1994 | B | 13 | 11-3)Others | 3nd issue |
| | | | | h)Caution for stress has been added | (Added) |

# RECORDS OF REVISION

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LD-6501C | SEP. 20. 1994 | C | 3 | 5. Absolute Maximum Ratings | 3rd Issue |
| | | | | Operating temperature(Topa) | |
| | | | | 0~+50℃ → 0~+40℃ | (Changed) |
| | | | 4 | 6-2)Backlight | |
| | | | | Lamp current($I_L$) | |
| | | | | Max. 4.0mArms→ 6.0mArms | (Changed) |
| | | | | Note 1.2 | (Changed) |
| | | | | Note | (Deleted) |
| | | | 5 | 7-1. Timing characteristics | |
| | | | | Frequency(clock) | |
| | | | | Max. 28.33(MHz) →31.5(MHz) | (Changed) |
| | | | 11 | 9. Optical Characteristics | |
| | | | | Luminance of white($Y_L$) | |
| | | | | Min. 45cd/m² Typ. 65cd/m² | |
| | | | | ↓ | |
| | | | | Luminance of white($Y_{L1}$) | |
| | | | | Min. 45cd/m² Typ. 65cd/m² | |
| | | | | Luminance of white($Y_{L2}$) | |
| | | | | Min. 85cd/m² Typ. 100cd/m² | (Changed) |
| | | | 14 | 13. Reliability test items | |
| | | | | 4 High temperature operation test | - |
| | | | | Ta=50℃ → Ta=40℃ | (Changed) |
| | | | 14. 16 | UL/CSA Label | (added) |
| | | | 14. 16. 17 | Bar code Label 73G7606→73G7605 | (Changed) |
| LD-6501D | OCT. 12. 1994 | D | 1 | Display size - Diagonal | (Changed) |
| | | | 3 | 5. Operating temperature | (Added) |
| | | | | $I_L$=3.5mA. 6.0mA | |

# RECORDS OF REVISION

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LD-6501D | OCT. 12. 1994 | D | 13 | 11-3 i), j) | (Added) |
| | | | 14 | 14.2) volume → voltage | (Changed) |
| | | | 14 | 14.2) technical literature → specification | (Changed) |
| LD-6501E | OCT. 27. 1994 | E | 11 | 9. Optical Characteristics | 5th Issue |
| | | | | Shadowing max. 2.0% | (Added) |
| | | | 13 | 【Note6】 | (Added) |

1. Application

This specification applies to color TFT-LCD module, LQ10D031.

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, power supply circuit and a backlight unit. Graphics and texts can be displayed on a 640x3x480 dots panel in 4,096 colors by supplying 12 bit data signal,four timing signals, +5V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight. Optimum viewing direction is 6 o'clock.

The 400 line and 350 line modes in addition to the 480 line modes can be also applied for this module.

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

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|---|---|---|
| Diagonal | 26 (10.4") ⚠ | cm |
| Active area | 211.2(H) × 158.4(V) | mm |
| Pixel format | 640(H) × 480(V) | pixels |
| | (1 pixel = R+G+B dots) | |
| Pixel pitch | 0.33(H) × 0.33(V) | mm |
| Pixel configuration | R,G,B vertical stripe | |
| Display mode | Normally white | |
| Unit outline dimensions | 242.8(W)x183.6(H)x8.3(D)(MAX) | mm |
| Mass | 480±10 | g |
| Screen surface treatment (Haze) | Anti-glare and hard-coating 2H (25±5) | (%) |

Outline dimensions are shown in Fig.1-①,②

LQ10D031



4. Input/Output Terminals

4-1) TFT-LCD panel driving

CN1 (Interface signal)

Used connector:DF9B-31P-1V (Hirose Electric Co.,Ltd.)

Corresponding connector:DF9 -31S-1V ( " )
DF9A-31S-1V ( " )
DF9B-31S-1V ( " )

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | GND | | |
| 2 | T2/GND | Terminal to sense the display type(to be grounded) | |
| 3 | NC | This is electrically opened. | |
| 4 | NC | This is electrically opened. | |
| 5 | Vsync | Vertical synchronous signal | 【Note1】 |
| 6 | Hsync | Horizontal synchronous signal | 【Note1】 |
| 7 | CK | Clock signal for sampling each data signal | |
| 8 | GND | | |
| 9 | R3 | RED data signal (MSB) | |
| 10 | R2 | RED data signal | |
| 11 | R1 | RED data signal | |
| 12 | R0 | RED data signal (LSB) | |
| 13 | GND | | |
| 14 | G0 | GREEN data signal (LSB) | |
| 15 | NC | This is electrically opened. | |
| 16 | ENAB | Data enable signal (to settle the viewing area) | 【Note2】 |
| 17 | Vcc | +5V power supply | |
| 18 | Vcc | +5V power supply | |
| 19 | NC | This is electrically opened. | |
| 20 | B3 | BLUE data signal (MSB) | |
| 21 | GND | | |
| 22 | NC | This is electrically opened. | |
| 23 | G3 | GREEN data signal (MSB) | |
| 24 | G2 | GREEN data signal | |
| 25 | G1 | GREEN data signal | |
| 26 | T1/NC | Terminal to sense the display type(to be opened) | |
| 27 | B2 | BLUE data signal | |
| 28 | B1 | BLUE data signal | |
| 29 | B0 | BLUE data signal (LSB) | |
| 30 | NC | This is electrically opened. | |
| 31 | GND | | |

【Note1】 Polarity of the sync. signals.

| mode | 480 lines | 400 lines | 350 lines |
|---|---|---|---|
| Hsync | negative | negative | positive |
| Vsync | negative | positive | negative |

It is equivalent to 480line mode if the both synchronous signals are positive.But the vertical display start timing is different from the normal 480line mode in this case.

※The shielding case is connected with GND.

LQ100031

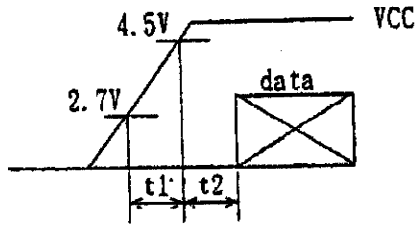


【Note1】

Vcc-turn-on conditions

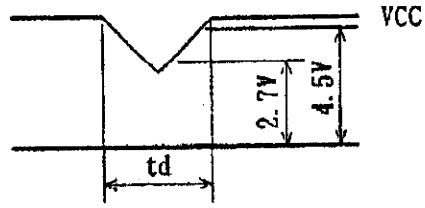
t1: rise time (0≤t≤10ms)

t2: data input allowance time (0≤t≤32ms)




Vcc-dip conditions

1) 2.7V ≤ Vcc < 4.5V
   td: Vcc-dip time (≤10ms)
2) Vcc < 2.7V
   (Vcc-dip conditions should also follow the Vcc-turn-on conditions)




【Note2】 Typical current situation : Black pattern.
(at 480 line mode. Vcc=5V)
【Note3】 CK,R0~R3,G0~G3,B0~B3,Hsync,Vsync,ENAB
【Note4】 CK,R0~R3,G0~G3,B0~B3,Hsync,Vsync
【Note5】 ENAB

6-2. Backlight

The backlight system is an edge-lighting type with single CCFT.
The characteristics of lamp are shown in the following table.

Ta=25℃

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Lamp voltage | $V_L$ | – | 600 | – | Vrms | Just for reference |
| Lamp current | $I_L$ | 2.5 | 3.5 | 6.0 | mArms | 【Note 1】 ⚠ ⚠ |
| Lamp power consumption | $P_L$ | – | 2.1 | – | W | 【Note 2】 |
| Lamp frequency | $F_L$ | 20 | – | 60 | kHz | |
| Kick-off voltage | $V_S$ | – | – | 1300 | Vrms | Ta=25℃ |
| | | – | – | 1500 | Vrms | Ta=0℃ |
| Lamp life time | $T_L$ | 10000 | – | – | h | 【Note 3】 |

【Note 1】 Available current range considering light-adjustment.
【Note 2】 Calculated value for reference. ($I_L$x$V_L$)
【Note 3】 Brightness becomes 50% of the original value under standard condition.
( $I_L$=3.5mArms )

LQ10D031



【Note2】 The horizontal display start timing is settled with a rising timing of this signal. In case ENAB is fixed "Low".The horizontal start timing is determind in the module. (refer to 7-2)


CN1 pin No.

4-2) Backlight driving

Used connector : BHR-03VS-1(JST)

Corresponding connector:SM02(8.0)B-BHS-1(JST)

CNA

| Pin no. | symbol | function |
|---|---|---|
| 1 | $V_{HIGH}$ | Power supply for lamp (High voltage side) |
| 2 | N C | This is electrically opened. |
| 3 | $V_{LOW}$ | Power supply for lamp (Low voltage side) |

5. Absolute Maximum Ratings

| Parameter | Symbol | Condition | Ratings | Unit | Remark |
|---|---|---|---|---|---|
| Input voltage | $V_I$ | Ta=25℃ | −0.3 ~ Vcc+0.3 | V | 【Note1】 |
| +5V supply voltage | Vcc | Ta=25℃ | 0 ~ + 7 | V | |
| Storage temperature | Tstg | − | −25 ~ +60 | ℃ | 【Note2】 |
| Operating temperature (Ambient) | Topa | $I_L$=3.5mA | 0 ~ +50 | ℃ | ⚠ |
| | | $I_L$=6.0mA | 0 ~ +40 | ℃ | |

【Note1】 CK. R0~R3. G0~G3. B0~B3. Hsync. Vsync. ENAB

【Note2】 Humidity : 95%RH Max. at Ta≤40℃.
Maximum wet-bulb temperature 39℃ or less at Ta>40℃.
No condensation.

6. Electrical Characteristics

6-1. TFT-LCD panel driving

Ta = 25℃

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| +5V | Supply voltage | Vcc | +4.5 | +5.0 | +5.5 | V | 【Note1】 |
| | Current dissipation | Icc | − | 200 | 500 | mA | 【Note2】 |
| Permissive input ripple voltage | | $V_{RP}$ | − | − | 100 | mVp-p | Vcc |
| Input voltage (Low) | | $V_{IL}$ | − | − | +1.5 | V | Vcc=+5V 【Note3】 |
| Input voltage (High) | | $V_{IH}$ | +3.5 | − | − | V | |
| Input current (low) | | $I_{IL}$ | − | − | 1.0 | μA | $V_I$=0V 【Note3】 |
| Input current (High) | | $I_{IH1}$ | − | − | 1.0 | μA | $V_I$=Vcc 【Note4】 |
| | | $I_{IH2}$ | − | − | 25.0 | μA | $V_I$=Vcc 【Note5】 |

7. Timing Characteristics of input signals

※Input signal waveforms are shown in Fig.2-①~③.

7-1. Timing characteristics

| Parameter | | Symbol | Mode | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | all | — | 25.18 | 31.5 | MHz | ⚠ |
| | High time | Tch | " | 5 | — | — | ns | |
| | Low time | Tcl | " | 10 | — | — | ns | |
| Data | Setup time | Tds | " | 5 | — | — | ns | |
| | Hold time | Tdh | " | 10 | — | — | ns | |
| Horizontal sync. signal | Cycle | TH | " | 30.00 | 31.78 | — | μs | |
| | | | " | 770 | 800 | 900 | clock | |
| | Pulse width | THp | " | 2 | 96 | 200 | clock | |
| Vertical sync. signal | Cycle | TV | 480 | 515 | 525 | 560 | line | |
| | | | 400 | 445 | 449 | 480 | line | |
| | | | 350 | 447 | 449 | 510 | line | |
| | Pulse width | TVp | all | 2 | — | 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 | ns | |

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

7-2. Horizontal display position and Data enable signal

Horizontal display position is setiled by data enable signal, horizontal display starts from rising of the data enable signal.

Timing characteristics

| Parameter | | Symbol | Mode | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Enable signal | Setup time | Tes | all | 5 | — | Tc-10 | ns | |
| | Pulse width | Tep | " | 2 | 640 | 640 | clock | |
| Hsync-Enable signal phase difference | | THe | " | 44 | — | 164 | clock | |

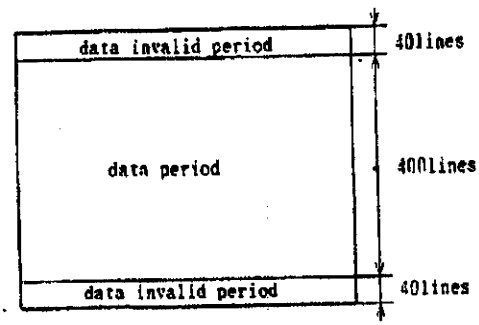
Note) If data enable terminal (ENAB) is fixed "Low",the display starts from the data of C104(clock) as shown in Fig.2-①~③.

7-3. Vertical display position

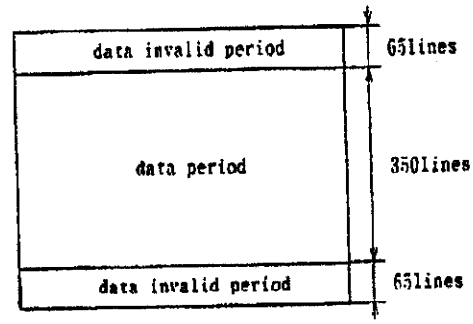
If sync. signals have the polarity described in 4-1,note1 and values in the following table, the vertical display position is automatically centered at each mode of VGA 480 line,400 line and 350 line modes.The data enable signal have no relation to the vertical display position.

| mode | V-data start(TVs) | V-data period(TVd) | V-display start | V-display period | Unit | Remark |
|---|---|---|---|---|---|---|
| 480 | 34 | 480 | 34 | 480 | line | |
| 400 | 34 | 400 | 443-TV | 480 | line | 【Note1】 |
| 350 | 61 | 350 | 445-TV | 480 | line | |

【Note1】 Since the data in vertical invalid data period is also displayed in 400 and 350 line mode,inputting all data "0" is recommended during data invalid period. (refer to the following figures)
In 400 and 350 line mode, the display position will not be centered on the screen if the cycle of vertical sync. signal, TV, deviates from above typical values.



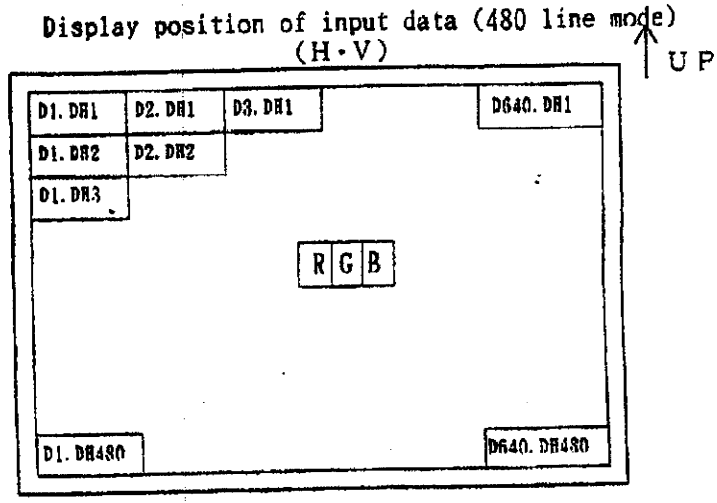

400 line mode (TV=449)




350 line mode (TV=449)

7-4.Input Data Signals and Display Position on the screen

Display position of input data (480 line mode)



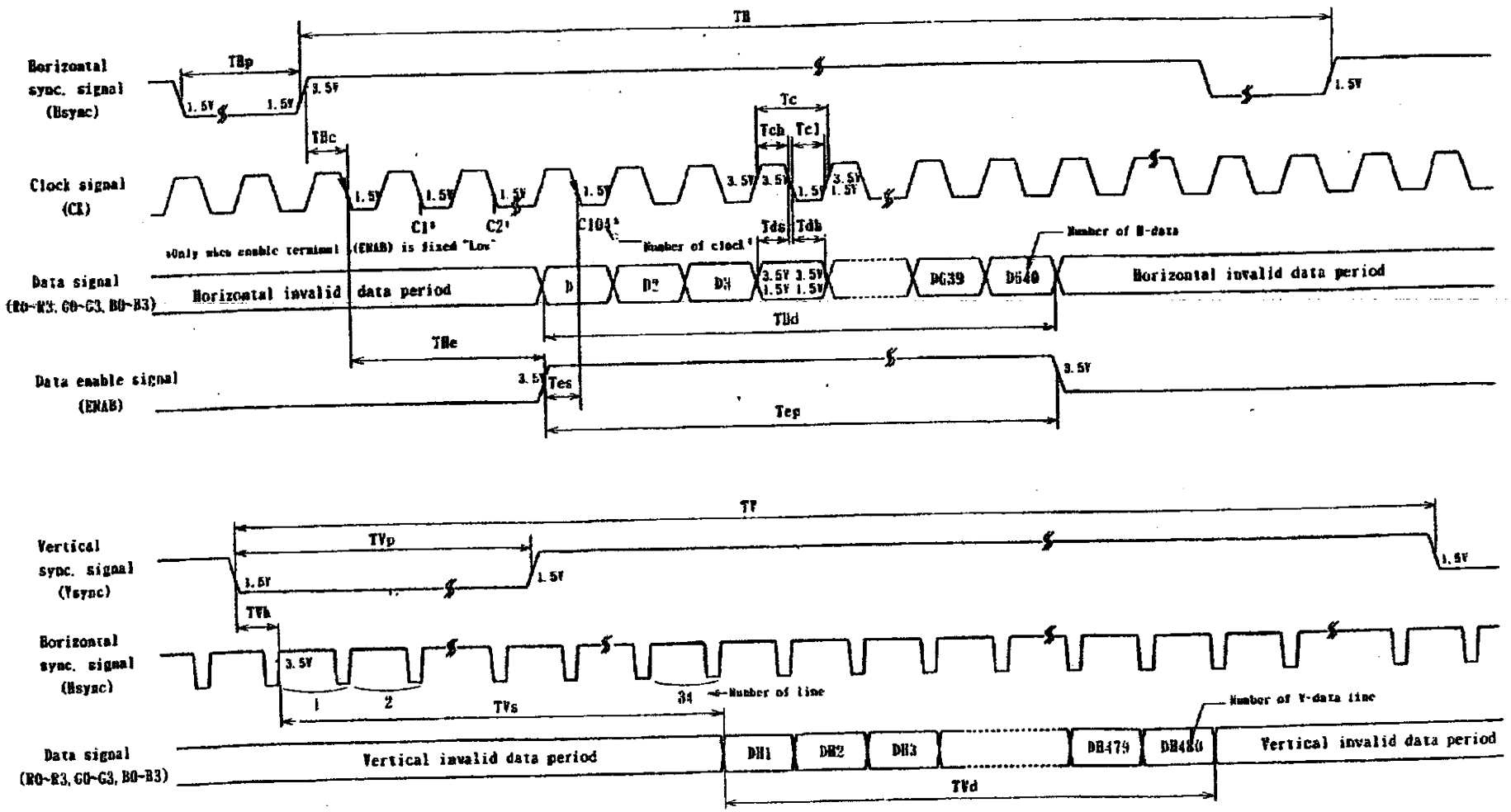



Fig. 2-0 Input signal waveforms (480 line mode)

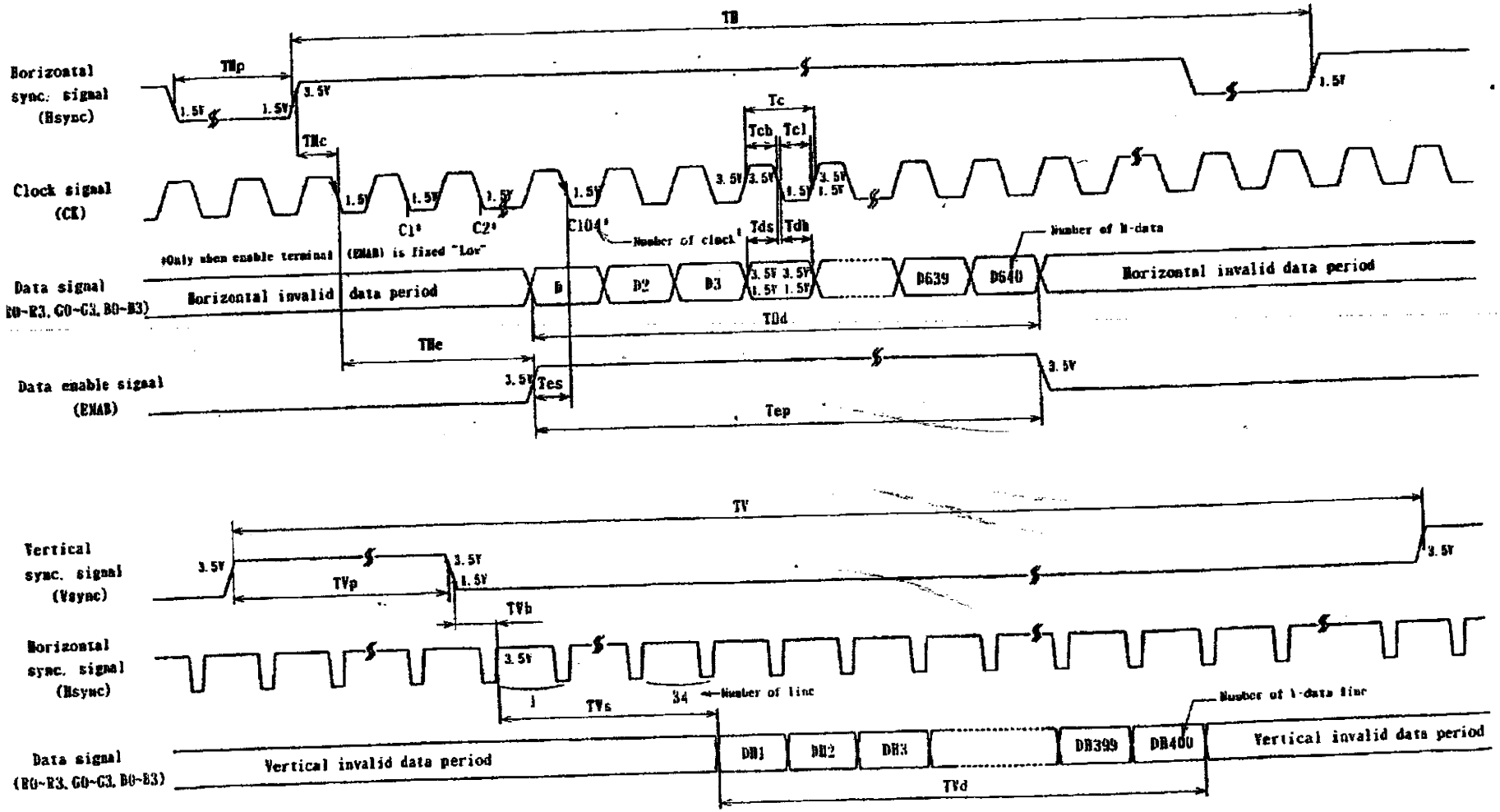



Fig. 2-② Input signal waveforms (400 line mode)

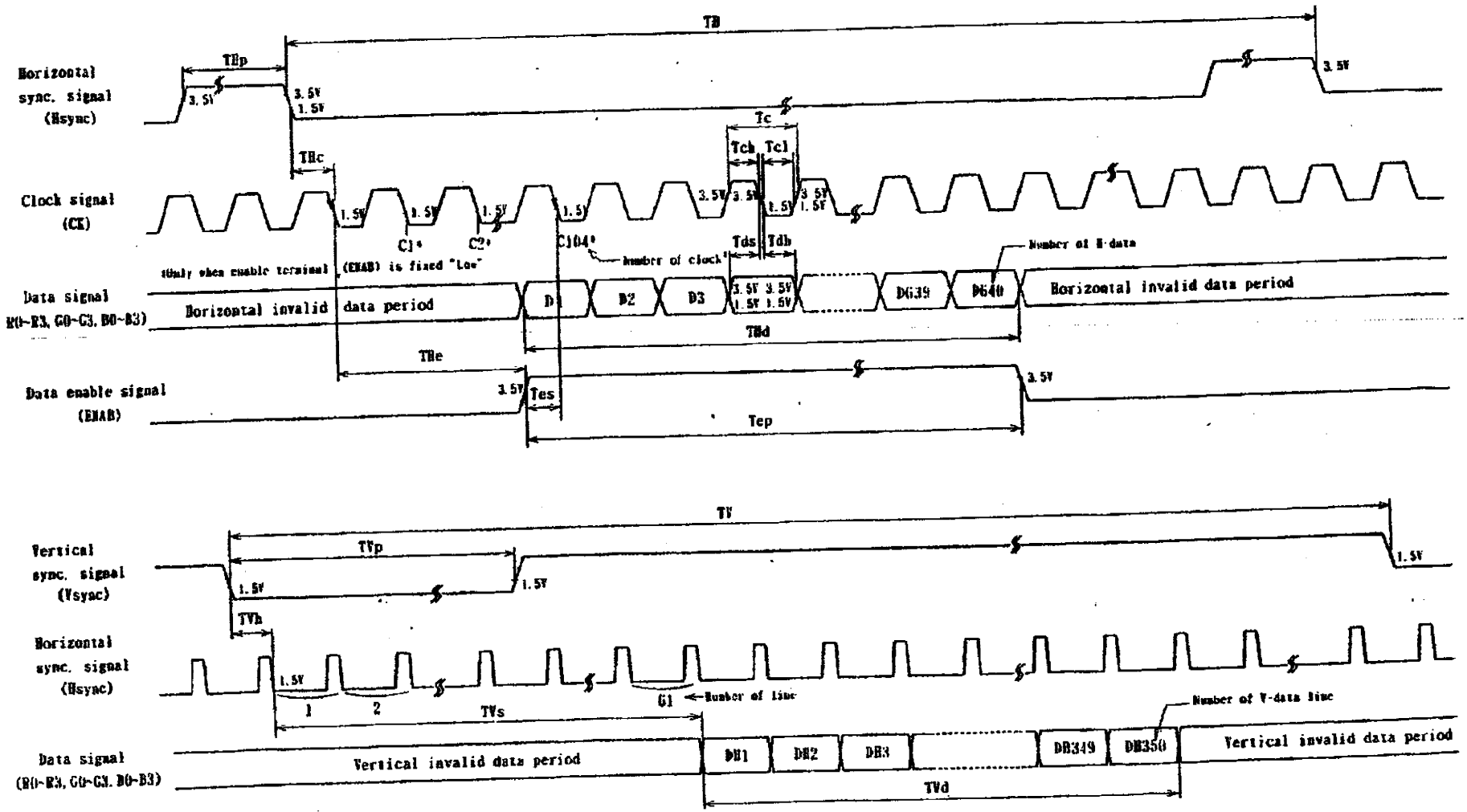



Fig. 2-6 Input signal waveforms (350 line mode)

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

| | color & Gray scale | Data signal | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R0 | R1 | R2 | R3 | G0 | G1 | G2 | G3 | B0 | B1 | B2 | B3 |
| Basic color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | Green | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | Light blue | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Purple | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale of Red | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | | | ⋮ | | | | ⋮ | | | | ⋮ | |
| | ⇩ | | | ⋮ | | | | ⋮ | | | | ⋮ | |
| | Brighter | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇩ | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | | | ⋮ | | | | ⋮ | | | | ⋮ | |
| | ⇩ | | | ⋮ | | | | ⋮ | | | | ⋮ | |
| | Brighter | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | ⇩ | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gray Scale of Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | ⇧ | | | ⋮ | | | | ⋮ | | | | ⋮ | |
| | ⇩ | | | ⋮ | | | | ⋮ | | | | ⋮ | |
| | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| | ⇩ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |

0: Low level voltage
1: High level voltage

Each colors are displayed in 16 gray scales from 4 bit data signals input.
According to the combination of total 12 bit data, 4096 colors are displayed.

9. Optical Characteristics

Ta=25℃, Vcc=+5V

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing angle range | Horizontal | θ21, 22 | CR>10 | 35 | – | – | ° | 【Note1, 4】 |
| | Vertical | θ11 | | 10 | – | – | ° | |
| | | θ12 | | 30 | – | – | ° | |
| Contrast ratio | | CR | Optimum viewing angle | 60 | – | – | | 【Note2, 4】 |
| Response time | Rise | τr | θ=0° | – | 30 | – | ms | 【Note3, 4】 |
| | Decay | τd | | – | 50 | – | ms | |
| Chromaticity of white | | x | | – | 0.313 | – | | 【Note4】 |
| | | y | | – | 0.329 | – | | |
| Luminance of white | $I_L$=3.5mA | $Y_{L1}$ | | 45 | 65 | – | cd/m² | |
| | $I_L$=6.0mA | $Y_{L2}$ | | 85 | 100 | – | cd/m² | |
| White Uniformity | | δw | | – | – | 1.45 | | 【Note5】 |
| Shadowing | | S | | – | – | 2.0 | % | 【Note6】 |

※The measurement shall be executed 15~20 minutes after lighting by useing the standard inverter(aa-617). The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below.

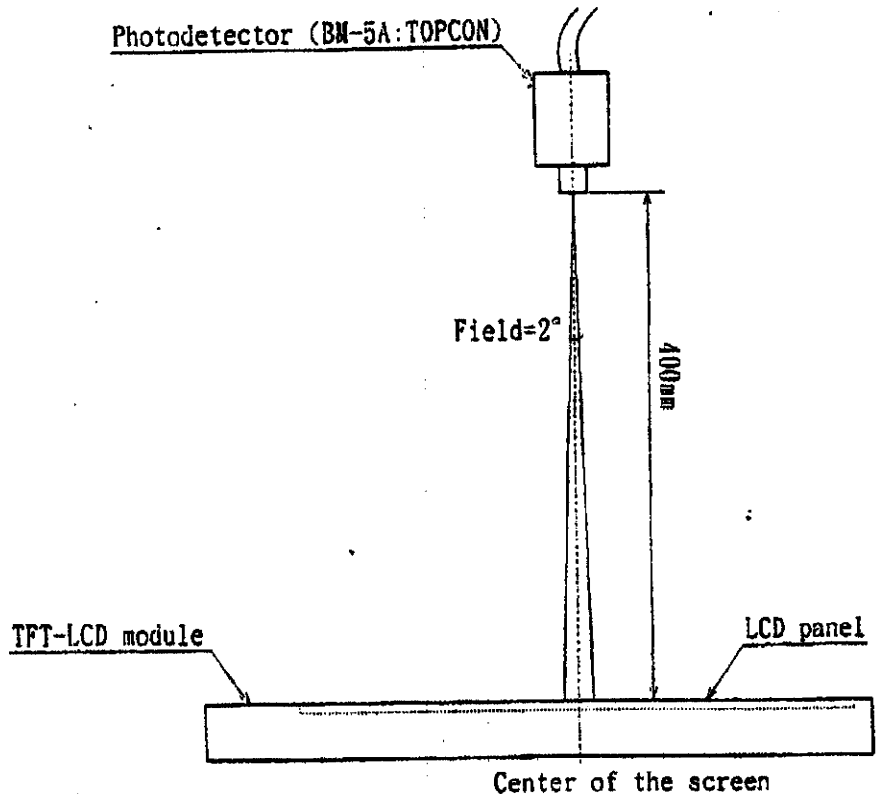
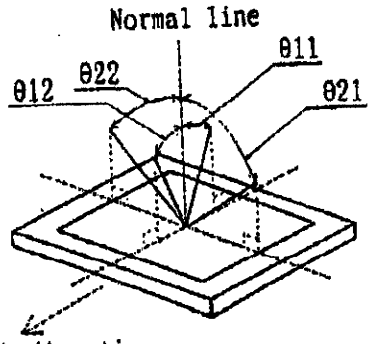



Fig.3 Optical characteristics measurement method

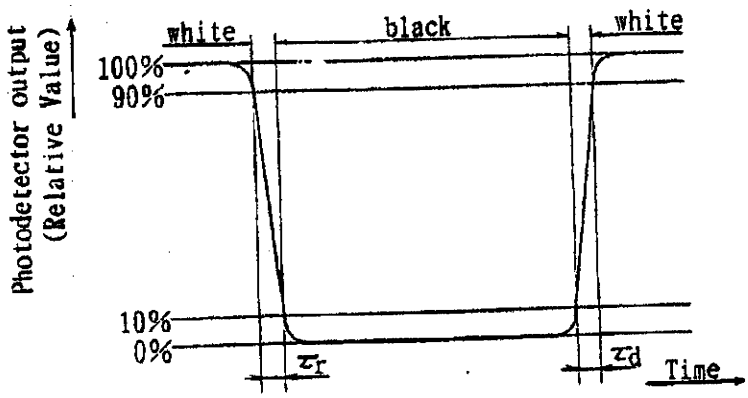
【Note1】 Definitions of viewing angle range:




【Note2】 Definition of Contrast Ratio:
The contrast ratio is defined as the following.

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

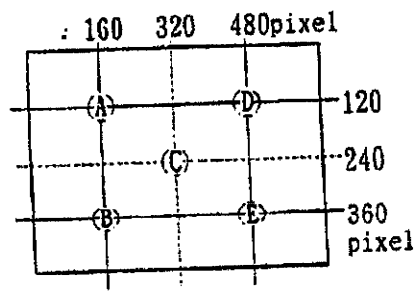
【Note3】 Definitions of Response Time:
The response time is defined as the following figure ($\tau_r$,$\tau_d$) by switching the input signals for "black" and "white".




【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).

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

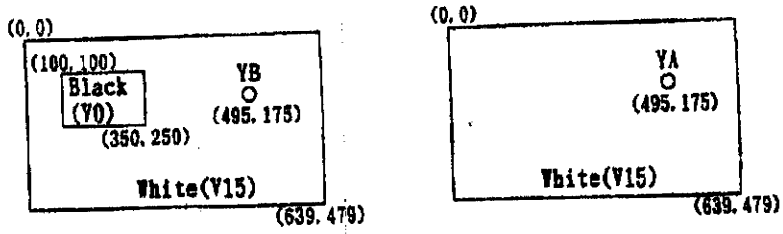


【Note6】 Definition of Shadowing ⚠

Shadowing is defined as follows.

$$S=(|YA-YB|/YA)\times 100(\%)$$

YA&YB:Brightness of same measured area




10. Display quality

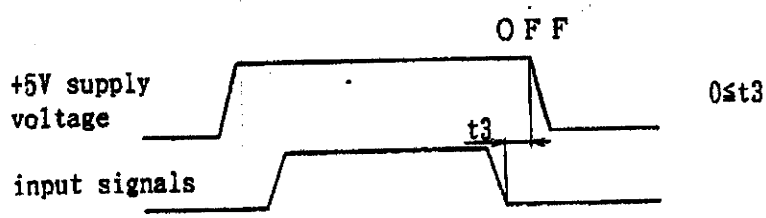
The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

11. Handling Precautions

11-1) Be sure to turn off the power supply when inserting or disconnecting the cable from the input connector.

11-2) Power OFF sequential timing

To prevent the latch-up of the circuit in the module, keep the sequential timing between the input signals and supply voltage as follows.




11-3) Others

a) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

b) Since the front polarizer is easily damaged, pay attention not to scratch it.

c) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

d) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

e) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

f) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.

g) Observe all other precautionary requirements in handling components.

h) This module has its circuitry PCBs on the rear side and should be carefully handled in order not to be stressed. Otherwise possibility occurs that some of the components are damaged.

i) Don't use any materials which emit following gas from epoxy resin(Amines'hardner) and silicone adhesive agent(Dealcohl or deoxym) to prevent change polarizer color owing to gas. ⚠

j) Laminated 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. Ionized air shall be blowed over during the action.Blow off 'dust' on the polarizer by using an ionized nitrogen gun.etc. ⚠

12. Packing form

a) Piling number of cartons : MAX.7

b) Package quantity in one carton : MAX.10

c) Carton size : 413(W)x288(H)x351(D)mm

d) Total mass of 1 carton filled with full modules : 7500g

Packing form is show in FIg.4.

13. Reliability test items

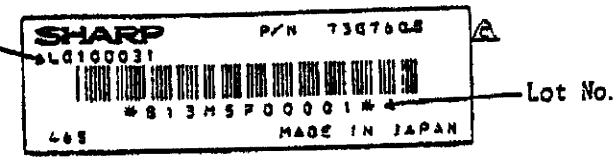
| No. | Test item | Conditions |
|---|---|---|
| 1 | High temperature storage test | Ta=60℃ 240h |
| 2 | Low temperature storage test | Ta=-25℃ 240h |
| 3 | High temperature & high humidity operation test | Ta=40℃:95%RH 240h<br>(No condensation) |
| 4 | High temperature operation test | Ta=40℃ 240h<br>(The panel temp. must be less than 60℃) |
| 5 | Low temperature operation test | Ta=0℃ 240h |
| 6 | Vibration test<br>(non-operating) | Frequency:10~57Hz/Vibration width (one side):0.075mm<br>:58~500Hz/Gravity:9.8m/s$^2$<br>Sweep time : 11 minutes<br>Test period : 3 hours<br>(1 hour for each direction of X.Y.Z) |
| 7 | Shock test<br>(non-operating) | Max. gravity : 490m/s$^2$<br>Pulse width : 11ms, half sine wave<br>Direction : ±X, ±Y, ±Z<br>once for each direction. |

【Result Evaluation Criteria】

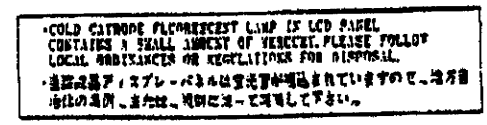
Under the display quality test conditions with normal operation state. these shall be no change which may affect practical display function.

14. Others

1-1) Bar code Label:




1-2) Caution-Label:




1-3) UL/CSA Label:


2) Adjusting voltage has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the data mentioned in this specification may not be satisfied.
3) Disassembling the module can cause permanent damage and should be strictly avoided.
4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
5) If any problem occures in relation to the description of this specification, it shall be resolved through discussion with spirit of cooperation.

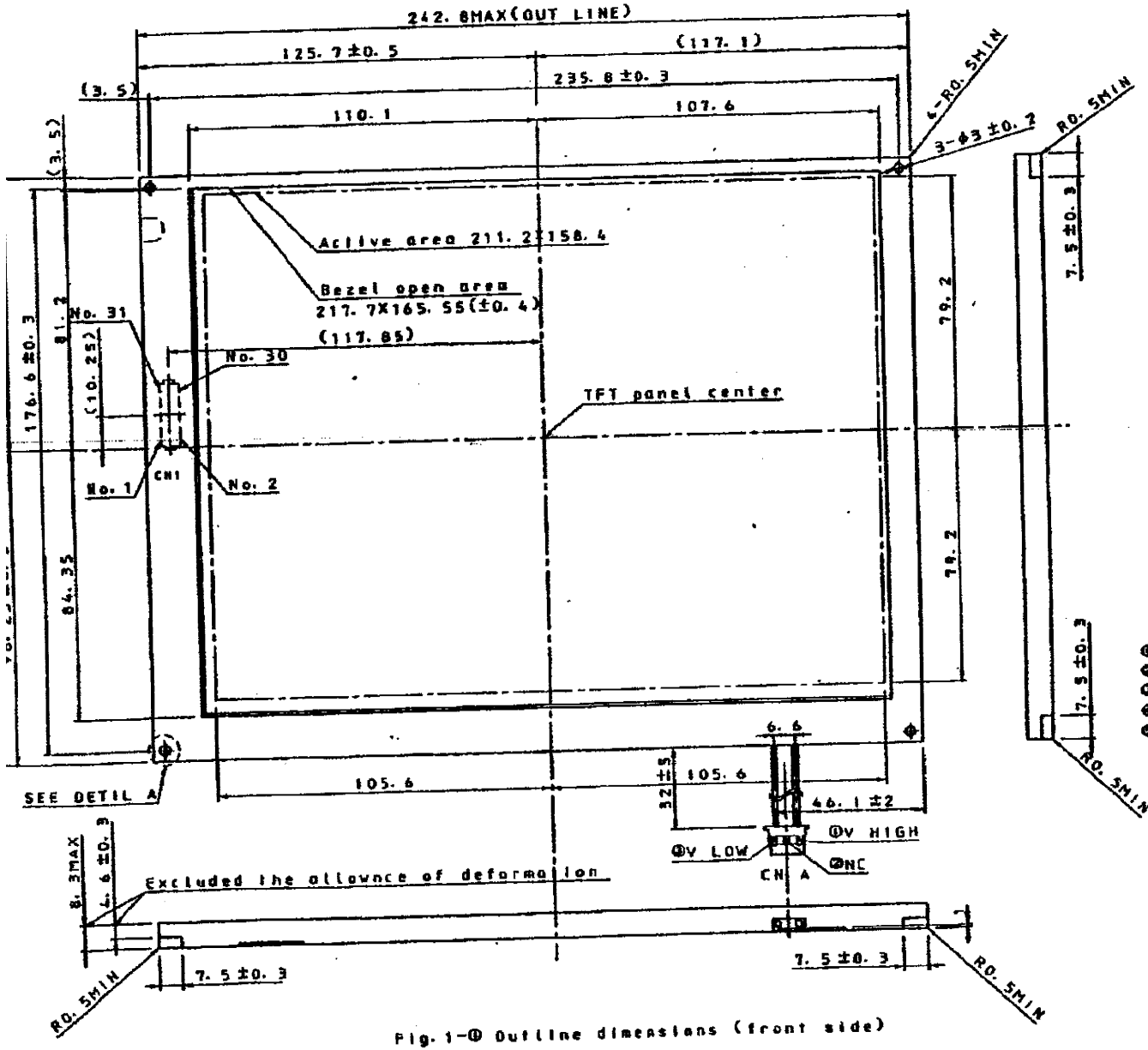
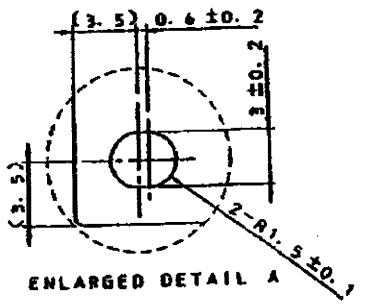
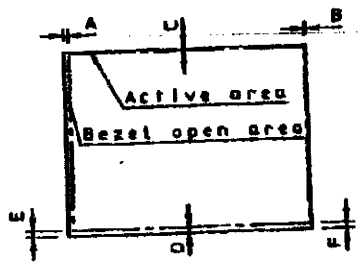



Fig.1-① Outline dimensions (front side)



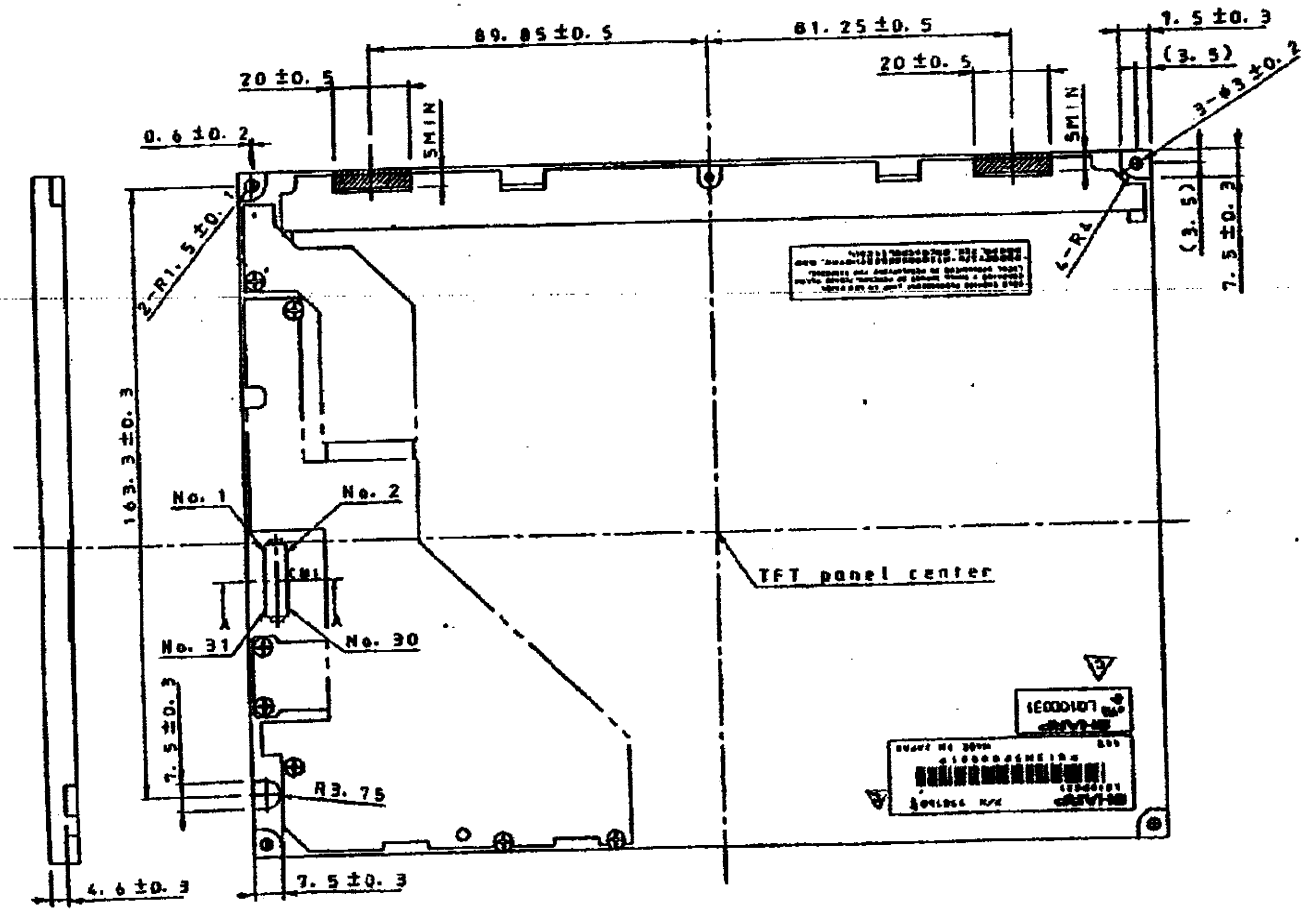

ENLARGED DETAIL A

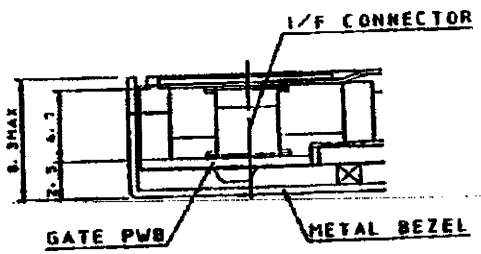
BEZEL/DISPLAY POSITION



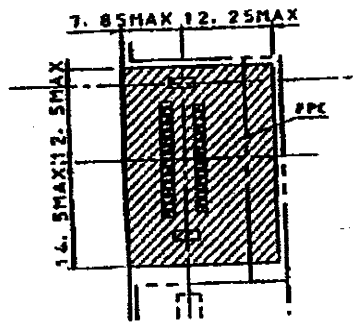

①TOLERANCE X-DIRECTION A:4.5±0.8
②TOLERANCE X-DIRECTION B:2.0±0.8
③TOLERANCE Y-DIRECTION C:2.0±0.8
④TOLERANCE Y-DIRECTION D:5.15±0.8
⑤OBLIQUITY OF DISPLAY AREA |E-F|<0.8

※UNSPECIFIED TOLERANCE TO BE ±0.5



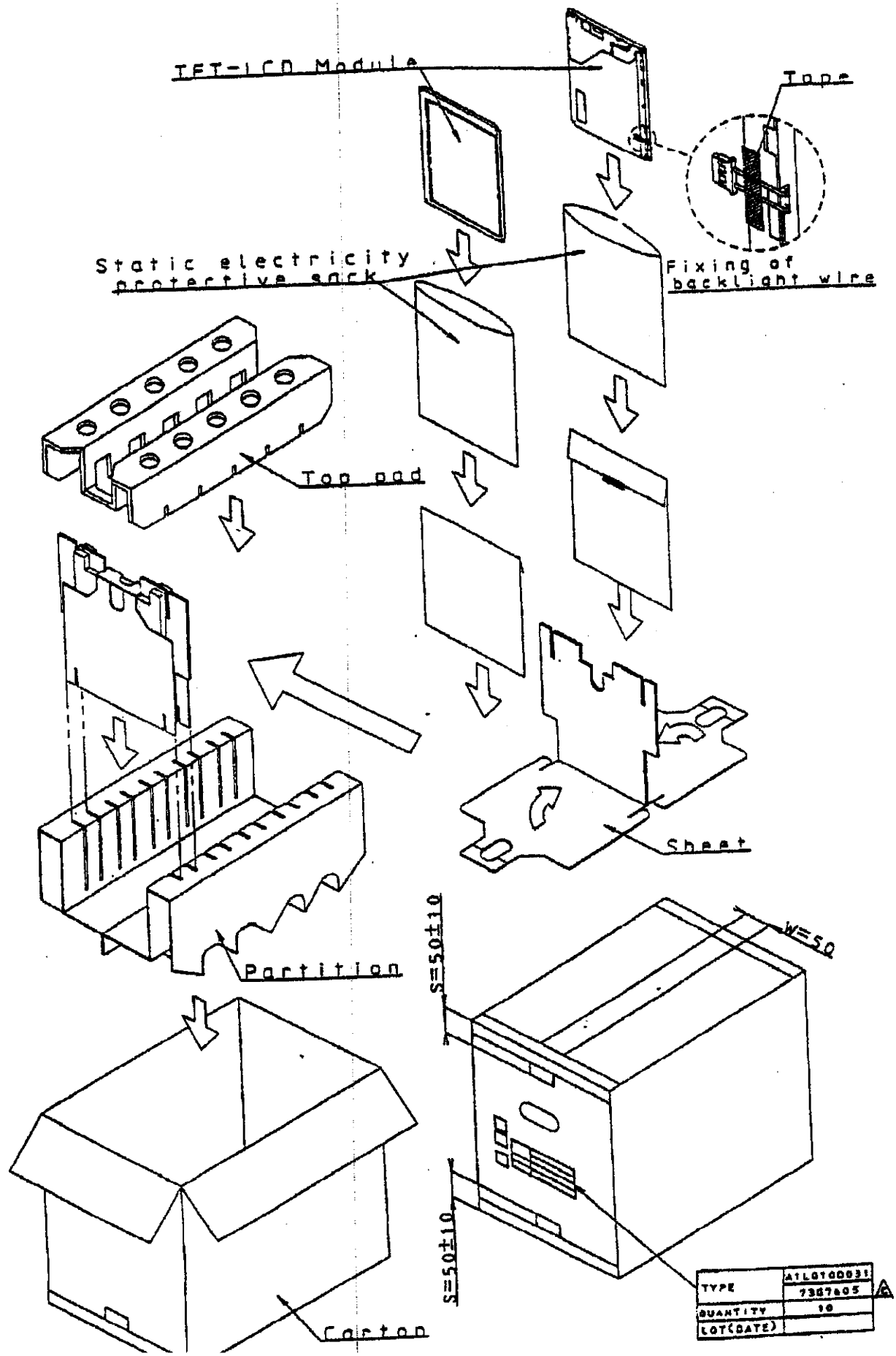

A-A Section




Dimensions of open area for I/F-FPC connector

※UNSPECIFIED TOLERANCE TO BE ±0.5

Fig. 1-② Outline dimensions (rear side)


TFT-LCD Module
Tape
Static electricity protective sack
Fixing of backlight wire
Top pad
Sheet
Partition
S=50±10
W=50
S=50±10
Carton
TYPE
A1L0T00031
7387605
QUANTITY
10
LOT(DATE)