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| PREPARED BY : DATE | SHARP | SPEC No. LD-14702 |
| | | FILE No. |
| APPROVED BY : DATE | | ISSUE : Jul. 1.2002 |
| | | PAGE : 18 pages |
| | AVC LIQUID CRYSTAL DISPLAY GROUP<br>SHARP CORPORATION<br>SPECIFICATION | APPLICABLE GROUP<br>AVC LIQUID CRYSTAL DISPLAY GROUP |

DEVICE SPECIFICATION FOR

# TFT-LCD Module

MODEL No.

# LQ104V1DG21

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

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# RECORDS OF REVISION

LQ104V1DG21

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LD-14702 | Jul. 1.2002 | – | – | | 1st Issue |

1. Application

This specification applies to color TFT-LCD module, LQ104V1DG21

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The device listed in these specification sheets was designed and manufactured for use in general electronic equipment.

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

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

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2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit and power supply circuit and a backlight unit. Graphics and texts can be displayed on a 640 × 3 × 480 dots panel with 262,144 colors by supplying 18 bit data signal (6bit/color), four timing signals,+3.3V/ +5V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

The TFT-LCD panel used for this module is a low-reflection and higher-color-saturation type. Therefore, this module is also suitable for the multimedia use.

Optimum viewing direction is 6 o'clock.

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

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|---|---|---|
| Display size | 26 (10.4") Diagonal | cm |
| Active area | 211.2(H) × 158.4(V) | mm |
| Pixel format | 640(H) × 480(V) | pixel |
| | (1 pixel = R + G + B dots) | |
| Pixel pitch | 0.330(H) × 0.330(V) | mm |
| Pixel configuration | R,G,B vertical stripe | |
| Display mode | Normally white | |
| Unit outline dimensions *1 | 265.0(W) × 195.0(H) × 11.5max(D) | mm |
| Mass | 700(max) | g |
| Surface treatment | Anti-glare and hard-coating 3H | |

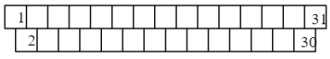
*1.Note: excluding backlight cables.

Outline dimensions is shown in Fig.1

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 Used connector:DF9MA-31P-1V (Hirose Electric Co., Ltd.)




CN1 pin arrangement from module surface
(Transparent view)

Corresponding connector: DF9-31S-1V ( 〃 )
DF9A-31S-1V( 〃 )
DF9B-31S-1V( 〃 )
DF9M-31S-1V( 〃 )

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | GND | | |
| 2 | CK | Clock signal for sampling each data signal | |
| 3 | Hsync | Horizontal synchronous signal | 【Note1】 |
| 4 | Vsync | Vertical synchronous signal | 【Note1】 |
| 5 | GND | | |
| 6 | R0 | ＲＥＤ data signal(LSB) | |
| 7 | R1 | ＲＥＤ data signal | |
| 8 | R2 | ＲＥＤ data signal | |
| 9 | R3 | ＲＥＤ data signal | |
| 10 | R4 | ＲＥＤ data signal | |
| 11 | R5 | ＲＥＤ data signal(MSB) | |
| 12 | GND | | |
| 13 | G0 | ＧＲＥＥＮ data signal(LSB) | |
| 14 | G1 | ＧＲＥＥＮ data signal | |
| 15 | G2 | ＧＲＥＥＮ data signal | |
| 16 | G3 | ＧＲＥＥＮ data signal | |
| 17 | G4 | ＧＲＥＥＮ data signal | |
| 18 | G5 | ＧＲＥＥＮ data signal(MSB) | |
| 19 | GND | | |
| 20 | B0 | ＢＬＵＥ data signal(LSB) | |
| 21 | B1 | ＢＬＵＥ data signal | |
| 22 | B2 | ＢＬＵＥ data signal | |
| 23 | B3 | ＢＬＵＥ data signal | |
| 24 | B4 | ＢＬＵＥ data signal | |
| 25 | B5 | ＢＬＵＥ data signal(MSB) | |
| 26 | GND | | |
| 27 | ENAB | Signal to settle the horizontal display position | 【Note2】 |
| 28 | Vcc | +3.3/5.0V power supply | |
| 29 | Vcc | +3.3/5.0V power supply | |
| 30 | R/L | Horizontal display mode select signal | 【Note3】 |
| 31 | U/D | Vertical display mode select signal | 【Note4】 |

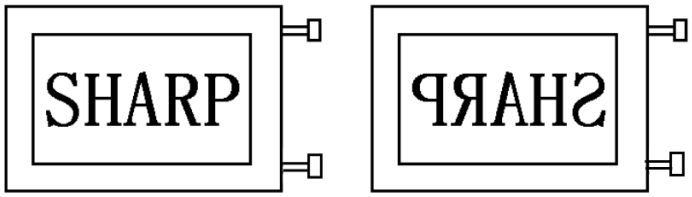
※The shielding case is connected with GND.

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

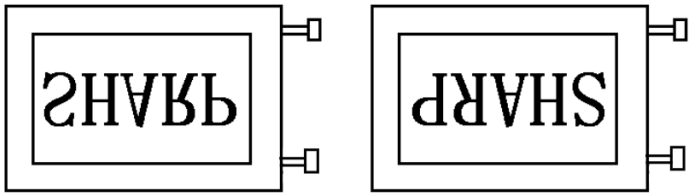
| Mode | 480 lines | 400 lines | 350 lines |
|---|---|---|---|
| Hsync | Negative | Negative | Positive |
| Vsync | Negative | Positive | Negative |

【Note2】The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in 7-2. Don't keep ENAB " High" during operation.

【Note3】R / L = H i g h、U / D = L o w　　R / L = L o w、U / D = L o w




【Note4】R / L = H i g h、U / D = H i g h　　R / L = L o w、U / D = H i g h




4-2. Backlight driving

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

CN2、CN3　　Corresponding connector :SM02(8.0)B-BHS(JST)

| Pin no. | Symbol | Function |
|---|---|---|
| 1 | $V_{HIGH}$ | Power supply for lamp (High voltage side) |
| 2 | NC | 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 ~ + 6 | V | |
| Storage temperature | Tstg | - | - 30 ~ + 70 | ℃ | 【Note2】 |
| Operating temperature (Ambient) | Topa | - | - 10 ~ + 65 | ℃ | |

【Note1】CK,R0 ~ R5,G0 ~ G5,B0 ~ B5,Hsync,Vsync,ENAB, R/L, U/L

【Note2】Humidity: 95%RH Max. at Ta≦40℃.

Maximum wet-bulb temperature at 39℃ or less at Ta>40℃.

No condensation.

6. Electrical Characteristics

6-1.TFT-LCDpaneldriving

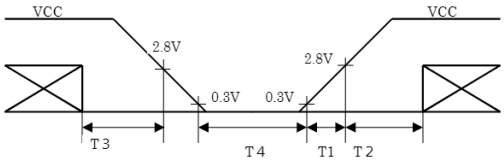
Ta = 25℃

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Power Supply | Supply voltage | Vcc | +3.0 | +3.3 / +5.0 | +5.5 | V | 【Note1】 |
| | Current dissipation | Icc | - | (180) | TBD | mA | Vcc=3.3V 【Note2】 |
| | | Icc | - | (150) | TBD | mA | Vcc=5.0V 【Note2】 |
| Permissive input ripple voltage | | $V_{RF}$ | - | - | 100 | mVp-p | |
| Input voltage (Low) | | $V_{IL}$ | - | - | 0.3Vcc | V | |
| Input voltage (High) | | $V_{IH}$ | 0.7Vcc | - | - | V | 【Note3】 |
| Input current (low) | | $I_{OL1}$ | - | - | 1.0 | μA | $V_I$=0V 【Note4】 |
| | | $I_{OL2}$ | - | - | 60.0 | μA | $V_I$=0V 【Note5】 |
| Input current (High) | | $I_{OH1}$ | - | - | 1.0 | μA | $V_I$=Vcc 【Note6】 |
| | | $I_{OH2}$ | - | - | 60.0 | μA | $V_I$=Vcc 【Note7】 |

【NOTE 1】

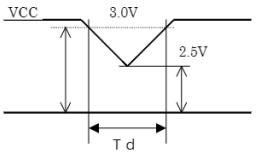
Vcc-turn-on conditions

T1≦15ms
0<T2≦100ms
0<T3≦1s
T4>200ms




Vcc-dip conditions

1) 2.5V≦Vcc<3.0V
td≦10ms
2) Vcc<2.5V
Vcc-dip condition should also follow
The Vcc-turn-on conditions




【Note2】 Typical current situation : 16-gray-bar pattern.
480 line mode/Vcc=+3.3V/+5.0V

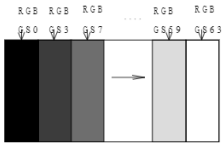
【Note3】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB, R/L,U/D

【Note4】 CK,R0~R5,G0~G5,B0~B5,Hsync,Vsync,ENAB

【Note5】 R/L

【Note6】 CK,R0~R5,G0~G5,B0~B5,Hsnc,Vsync

【Note7】 ENAB,U/D



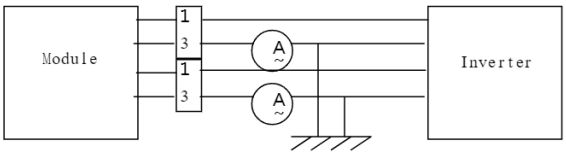
6-2. Backlight driving

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

Ta=25°C

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Lamp current | $I_L$ | 2.0 | 6.0 | 6.5 | mArms | 【Note1】 |
| Lamp power consumption | $P_L$ | - | 3.0 | - | W | 【Note2】 |
| Lamp frequency | $F_L$ | 20 | 35 | 60 | KHz | 【Note3】 |
| Kick-off voltage | Vs | - | - | (950) | Vrms | Ta=25°C |
| | | - | - | (1250) | Vrms | Ta =0°C【Note4】 |
| | | - | - | (1500) | Vrms | Ta =-10°C【Note4】 |
| Lamp life time | $L_L$ | 50000 | - | - | hour | 【Note5】 |

【Note1】 Lamp current is measured with current meter for high frequency as shown below.




* 3pin is V LOW

【Note2】 At the condition of $I_L$=6.0mArms

【Note3】 Lamp frequency may produce interference with horizontal synchronous frequency,and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and from the harmonics of horizontal synchronous to avoid interference.

【Note4】 The open output voltage of the inverter shall be maintained for more than 1sec; otherwise the lamp may not be turned on.

【Note5】 Since lamp is consumables, the life time written above is referencial value and it is not guaranteed in this specification sheet by SHARP.

Lamp life time is defined that it applied either ① or ② under this condition

(Continuous turning on at Ta=25°C, IL=6.0mArms)

① Brightness becomes 50% of the original value under standard condition.

② Kick-off voltage at Ta=-10°C exceeds maximum value,(1500)Vrms.

In case of operating under lower temp environment, the lamp exhaustion is accelerated and the brightness becomes lower.
(Continuous operating under for around 1 month under lower temp condition may reduce the brightness to half of the original brightness.)
In case of such usage under lower temp environment, periodical lamp exchange is recommended.

【Note6】 The performance of the backlight, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting,flicker, etc.) never occur. when you confirm it, the module should be operated in the same condition as it is installed in your instrument.

【Note7】 It is required to have the inverter designed so that to allow the impedance deviation of the two CCFT lamps and the capacity deviation of barast capacitor.

7. Timing Characteristics of input signals

Timing diagrams of input signal 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 | 28.33 | 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 | |
| | | | 〃 | 750 | 800 | 900 | clock | |
| | Pulse width | THp | 〃 | 2 | 96 | 200 | clock | |
| Vertical sync. signal | Cycle | TV | 480 | 515 | 525 | 560 | line | |
| | | | 400 | 446 | 449 | 480 | line | |
| | | | 350 | 447 | 449 | 510 | line | |
| | Pulsewidth | TVp | all | 1 | - | 34 | line | |
| Horizontal display period | | THd | 〃 | 640 | 640 | 640 | clock | |
| Hsync-Clock phase difference | | THc | 〃 | 10 | - | Tc-10 | ns | |
| Hsync-Vsync phase difference | | TVh | 〃 | 0 | - | TH-THp | clock | |

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

7-2. Horizontal display position

The horizontal display position is determined by ENAB signal and the input data corresponding to the rising edge of ENAB signal is displayed at the left end of the active area.

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

Note) When ENAB is fixed "Low", the display starts from the data of C104(clock) as shown in Fig.2-① ~ ③. Be careful that the module does not work when ENAB is fixed "High".

When the phase difference is below 104 clock, keep the “High level of ENAB is signal longer Than 104-The. If it will not be keeped, the display starts from the data of C104(clock).

7-3. Vertical display position

The vertical display position is automatically centered in the active area at each mode

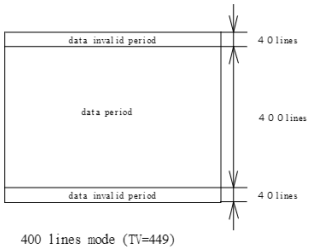
of VGA ,480-,400-,and 350-line mode . Each mode is selected depending on the polarity of the synchronous signals described in 4-1(Note1).

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

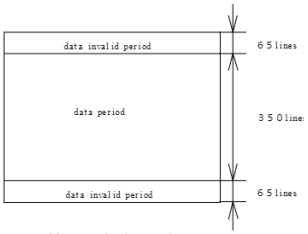
In 400-,and 350-line mode,the data in the vertical data invalid period is also displayed, So ,inputting all data "0" is recommended during vertical data invalid period.

ENAB signal has no relation to the vertical display position.

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

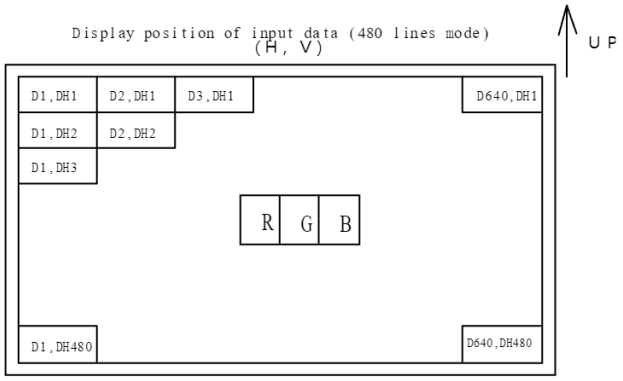



400 lines mode (TV=449)




350 lines mode (TV=449)

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



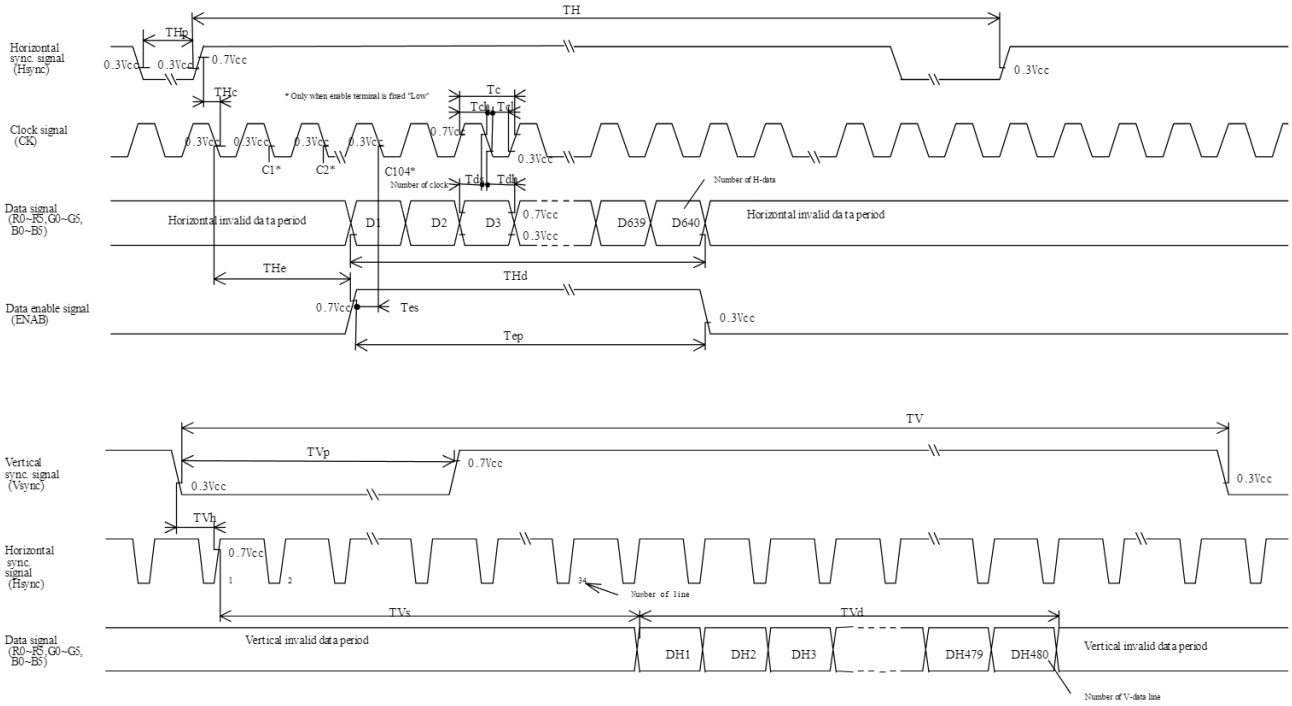






Fig 2-1 Input signal waveforms (480 line mode)

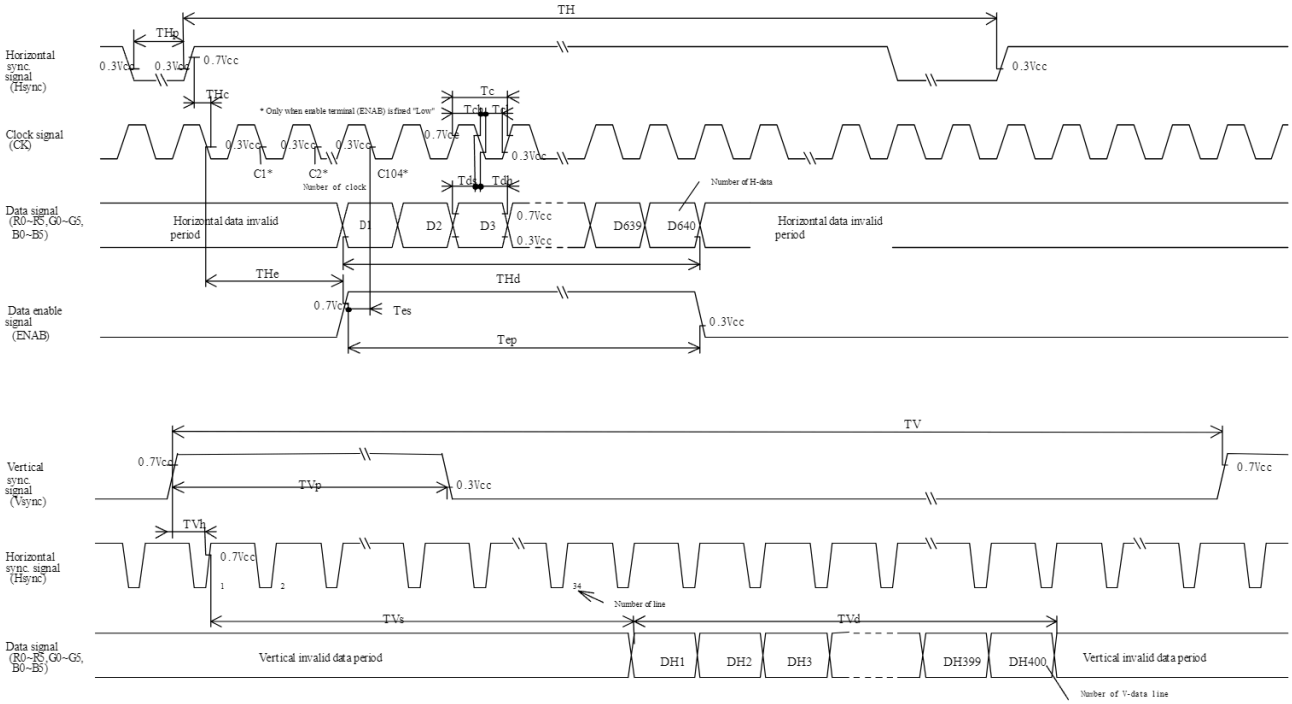



Fig.2-2 Input signal waveforms (400 line mode)

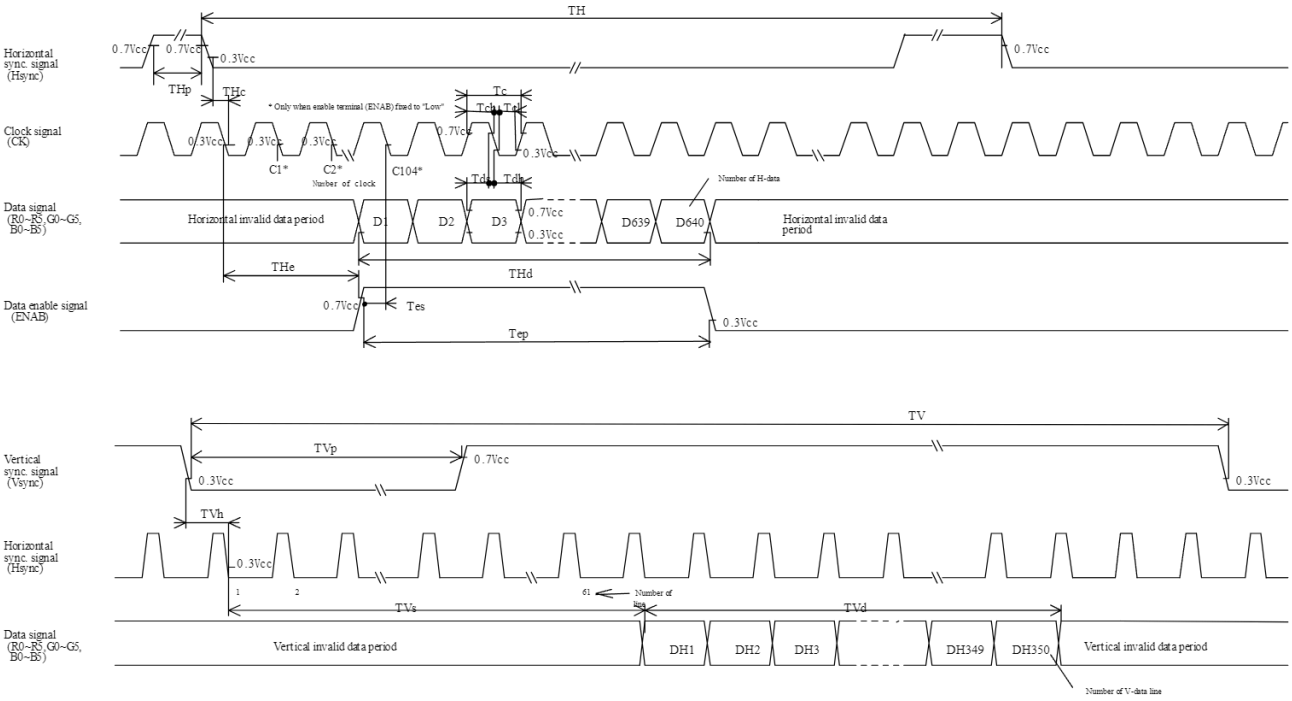



Fig.2-3 Input signal waveforms (350 line mode)

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

| | Colors & Gray scale | Gray Scale | Data signal | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | RA0 | RA1 | RA2 | RA3 | RA4 | RA5 | GA0 | GA1 | GA2 | GA3 | GA4 | GA5 | BA0 | BA1 | BA2 | BA3 | BA4 | BA5 |
| | | | RB0 | RB1 | RB2 | RB3 | RB4 | RB5 | GB0 | GB1 | GB2 | GB3 | GB4 | GB5 | BB0 | BB1 | BB2 | BB3 | BB4 | BB5 |
| Basic Color | Black | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | - | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | - | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale of Red | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | ↓ | | | | | | ↓ | | | | | | ↓ | | | |
| | ⇩ | ↓ | | | ↓ | | | | | | ↓ | | | | | | ↓ | | | |
| | Brighter | GS61 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇩ | GS62 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | GS63 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Green | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | ↓ | | | | | | ↓ | | | | | | ↓ | | | |
| | ⇩ | ↓ | | | ↓ | | | | | | ↓ | | | | | | ↓ | | | |
| | Brighter | GS61 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇩ | GS62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | GS63 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Blue | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | ↓ | | | | | | ↓ | | | | | | ↓ | | | |
| | ⇩ | ↓ | | | ↓ | | | | | | ↓ | | | | | | ↓ | | | |
| | Brighter | GS61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| | ⇩ | GS62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| | Blue | GS63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

0 :Low level voltage, 1 : High level voltage

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

9. Optical Characteristics

Ta=25℃, Vcc=+5V

| Parameter | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle Range | Horizontal | θ21, θ22 | CR>10 | 60 | 70 | - | Deg. | 【Note1,4】 |
| | Vertical | θ11 | | 35 | 40 | - | Deg. | |
| | | θ12 | | 55 | 70 | - | Deg. | |
| Contrast ratio | | CR | θ=0° | 150 | - | - | - | 【Note2,4】 |
| | | | Best Viewing Angle | - | 300 | - | - | |
| Response Time | Rise | τr | θ=0° | - | 20 | - | ms | 【Note3,4】 |
| | Decay | τd | | - | 40 | - | ms | |
| Chromaticity of White | | x | | - | 0.313 | - | | 【Note4】 |
| | | y | | - | 0.329 | - | | $I_L$=6.0mArms |
| Luminance of white | | $Y_L$ | | 280 | 350 | - | cd/m² | f=35kHz |
| White Unifomity | | δw | | - | - | 1.45 | - | 【Note5】 |
| Viewing Angle range as a Brightness Definition | Horizontal | θ21, θ22 | 50% of the maximum brightness | - | 50 | - | Deg. | 【Note1】 |
| | Vertical | θ11 | | - | 40 | - | Deg. | |
| | | θ12 | | - | 35 | - | Deg. | |

※The measurement shall be executed 30 minutes after lighting at rating. (condition:$I_L$=6.0mArms)

The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig.3 below.

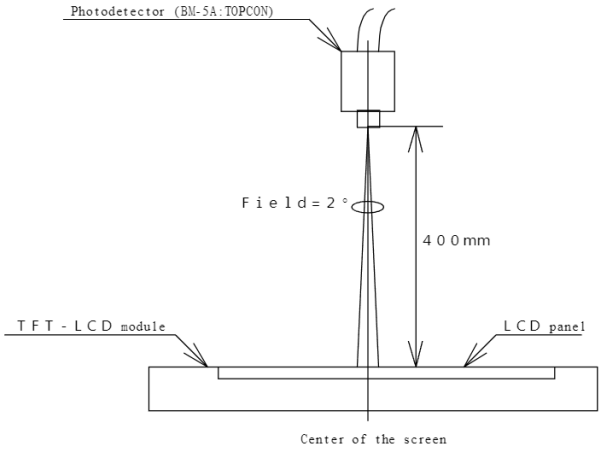
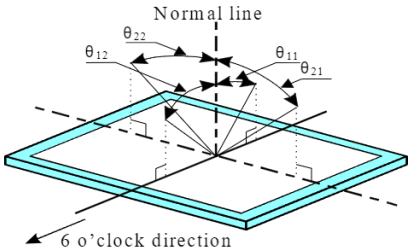



Fig.3 Optical characteristics measurement method

【Note1】Definitions of viewing angle range:



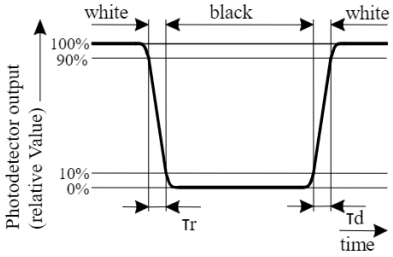

【Note2】Definition of contrast ratio:

The contrast ratio is defined as the following.

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

【Note3】Definition of response time:

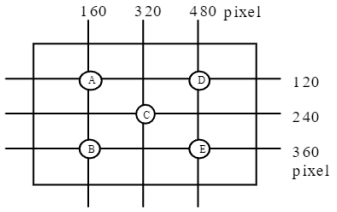
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .




【Note4】This shall be measured at center of the screen.

【Note5】Definition of white uniformity:

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




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

10. Display Quantity

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

11. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

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

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

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

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

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

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

h) Laminated film is attached to the module front and back 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 blown over during the action. Blow off 'dust' on the polarizer by using an ionized nitrogen

. i) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective board over the LCD. Be careful about the optical interface fringe etc. Which degrades display quality.

j)Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should beattached when LCD panel is used under such environment.

k) Connect GND to 4 place of mounting holes to stabilize against EMI and external noise.

l) There are high voltage portions on the backlight and very dangerous. Careless touch may lead to electrical shock. When exchange lamps or service. Turn off the power without tail.

m) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

n)Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.

12.Packing form

| | |
|---|---|
| Piling number of cartons | 7 （Max） |
| Packing quantity in one carton | 20 |
| Carton size [mm] | 525 (W)×309(D)×377(H) |
| Total mass of one carton filled with full modules | 17.5kg |
| Packing form is shown | Fig.4 |

13．Reliability test items

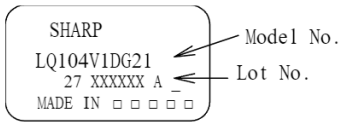
| No. | Test item | Conditions |
|---|---|---|
| 1 | High temperature storage test | Ta=70℃ 240h |
| 2 | Low temperature storage test | Ta= -30℃ 240h |
| 3 | High temperature & high humidity operation test | Ta=40℃ ; 95%RH 240h (No condensation) |
| 4 | High temperature operation test | Ta=65℃ 240h |
| 5 | Low temperature operation test | Ta= -10℃ 240h |
| 6 | Vibration test (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 (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.

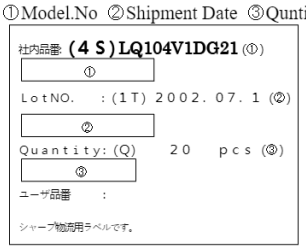
14．Others

1) Label: Module




Packing box

①Model.No ②Shipment Date ③Quntity




2) 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.

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 occurs in relation to the description of this specification , it shall be resolved through discussion with spirit of cooperation.

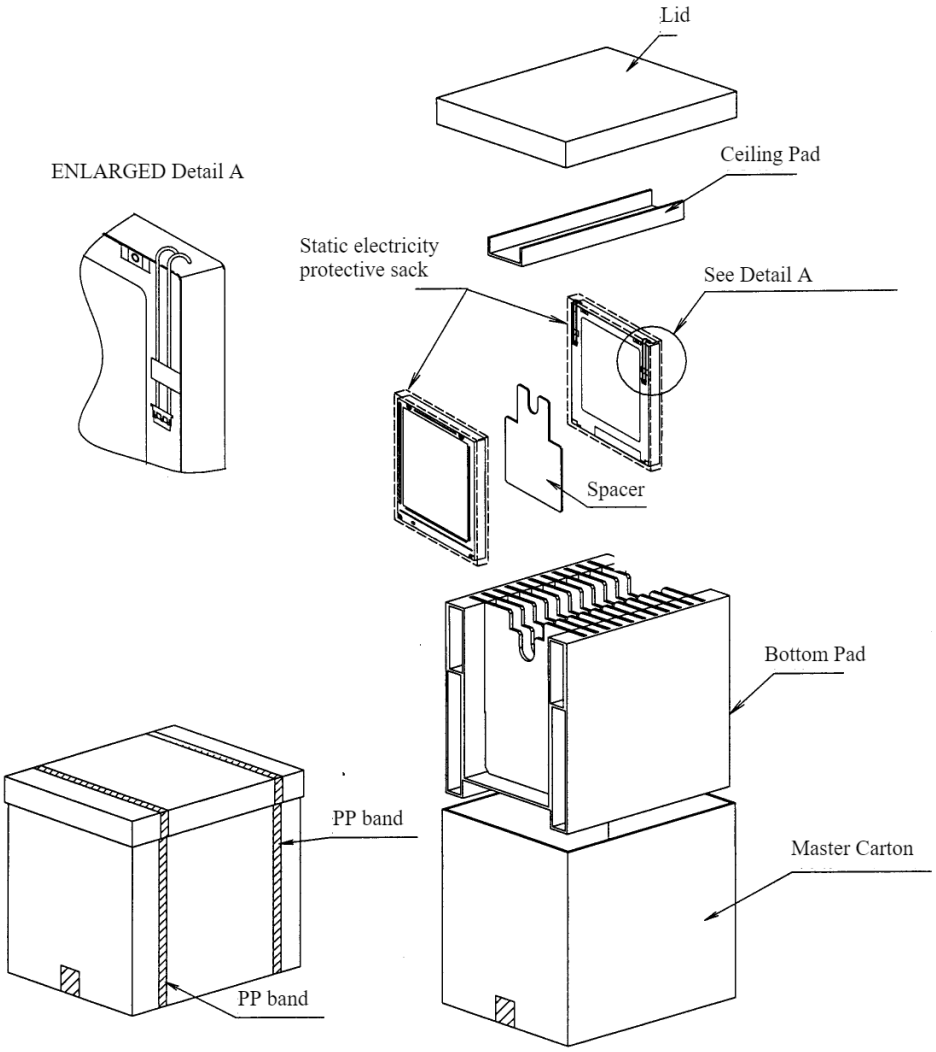



Fig.4 Packing Form

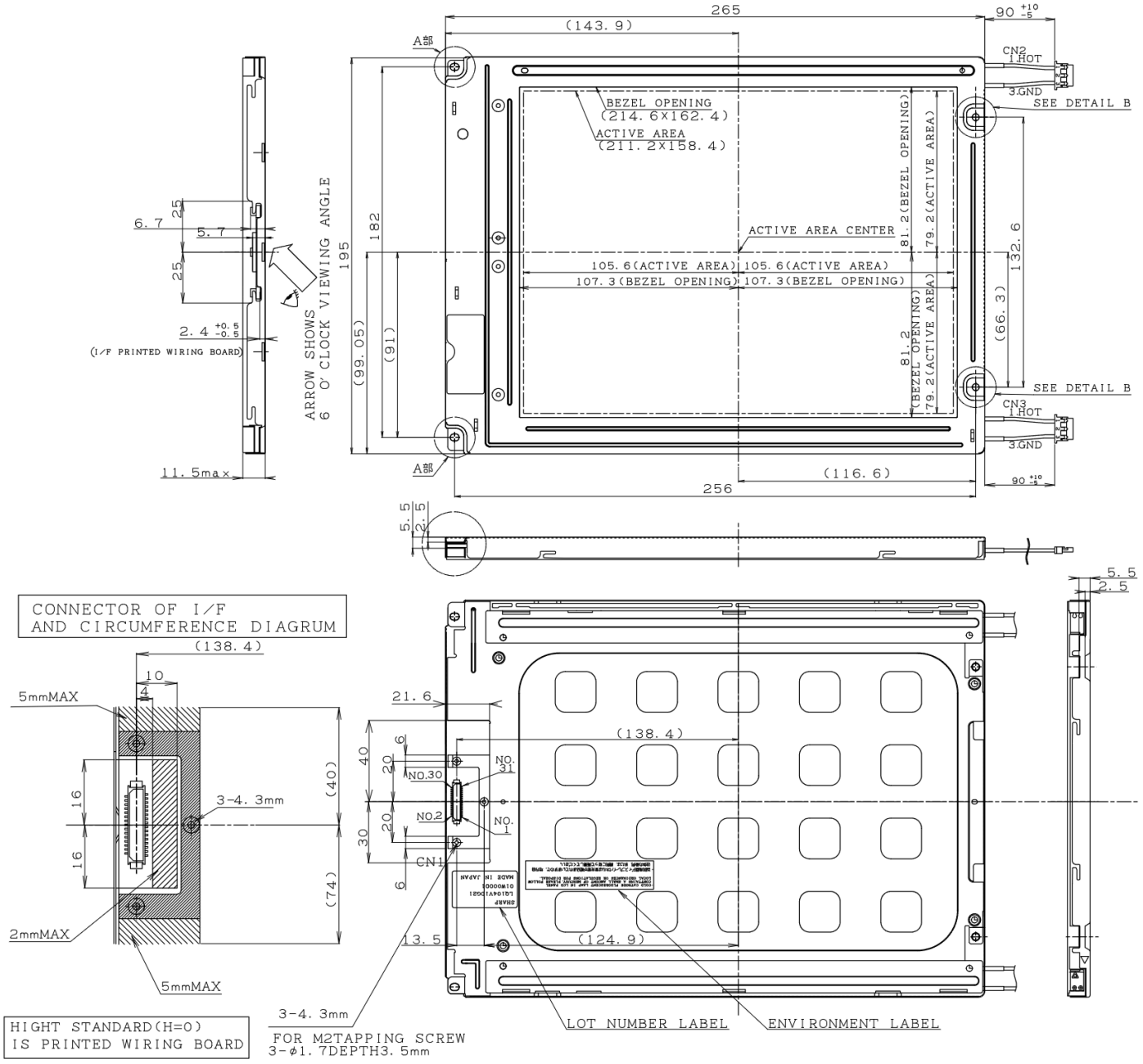



Fig.1 Outline Dimensions

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