DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ141X1LH42

□ CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY *Makoto Takeda*

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1. Application

    This specification applies to a color TFT-LCD module, LQ141X1LH42

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 1024× 3× 768 dots panel with 262,144 colors by using LVDS (Low Voltage Differential Signaling) to interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

The TFT-LCD panel used for this module has very high aperture ratio. A low-reflection and higher-color-saturation type color filter is also used for this panel. Therefore, high-brightness and high-contrast image, which is suitable for the multimedia use, can be obtained by using this module.

    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	36 (14.1")　Diagonal	cm
Active area	285.7 (H)× 214.3 (V)	mm
Pixel format	1024 (H)× 768 (V)	pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.279 (H) × 0.279 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Unit outline dimensions (typ.)*1	298.5(W)× 226.5 (H)× 6.0max(D)	mm
Mass	530± 20	g
Surface treatment	Anti-glare and hard-coating 2H Low reflection (5%)	

    *1.Note : excluding backlight cables.

    Outline dimensions is shown in Fig.1

4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (LVDS signals and +3.3V DC power supply)

Using connector : FI-SEB20P-HF10 (JAE)

Corresponding connector : FI-SE20M (JAE), or FI-S20S(JAE)

Pin No.	Symbol	Function	Remark
1	Vcc	+3.3V power supply	
2	Vcc	+3.3V power supply	
3	GND		
4	GND		
5	RXIN0-	Receiver signal (-)	LVDS
6	RXIN0+	Receiver signal (+)	LVDS
7	GND		
8	RXIN1-	Receiver signal (-)	LVDS
9	RXIN1+	Receiver signal (+)	LVDS
10	GND		
11	RXIN2-	Receiver signal (-)	LVDS
12	RXIN2+	Receiver signal (+)	LVDS
13	GND		
14	RXCLK IN-	Clock signal (-)	LVDS
15	RXCLK IN+	Clock signal (+)	LVDS
16	GND		
17	RESERVED	This should be electrically opened during operation.	
18	RESERVED	This should be electrically opened during operation.	
19	GND		
20	GND		

Note 1   Relation between LVDS signals and actual data shows below section (4-2).

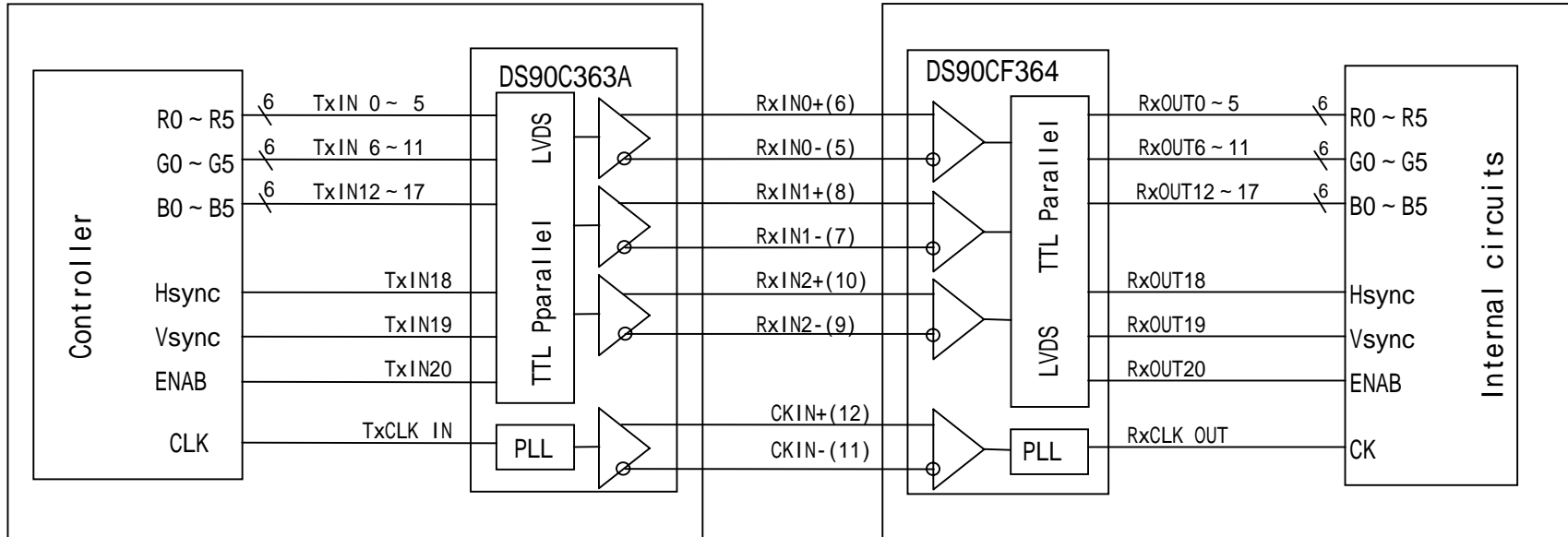Note 2   The shielding case is connected with signal GND.

4-2 Interface block diagram

Using receiver   DS90CF364(National semiconductor

Corresponding Transmitter   DS90C363,DS90C383,DS90C363A,DS90C383A(National semiconductor

Computer side   (TFT-LCD side)

4-3. Backlight driving

CN2 : BHSR-02VS-1(JST)

Mating connector : SM02B-BHSS-1-TB(JST)

Pin no.	symbol	function
1	HIGH	Power supply for lamp (High voltage side)
2	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		Note1
+3.3V supply voltage	Vcc	Ta=25	0	4		
Storage temperature	Tstg		25	60		Note2
Operating temperature (Ambient)	Topa		0	50		

Note1   LVDS signals

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-LCD panel driving   Ta   25

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Vcc	Supply voltage	Vcc	+3.0	+3.3	+3.6		Note2
	Current dissipation	Icc		400	560		Note3
Permissive input ripple voltage		V_{RP}			100	mV p-p	Vcc=+3.3V
Differential input threshold voltage	High	V_{TH}			+100	mV	V_{CM}=+1.2V
	Low	V_{TL}	–100			mV	Note1
Input current (High)		I_{OH}			± 10	μ A	V_I=2.4V Vcc=3.6V
Input current (Low)		I_{OL}			± 10	μ A	V_I=0V Vcc=3.6V
Terminal resistor		R_T		100			Differential input

Note1 V_{CM} : Common mode voltage of LVDS driver.

Note2
On-off conditions for supply voltage

   0   t1   10 ms

   0   t2   50 ms

   0   t3   1 s

      t4   1 s
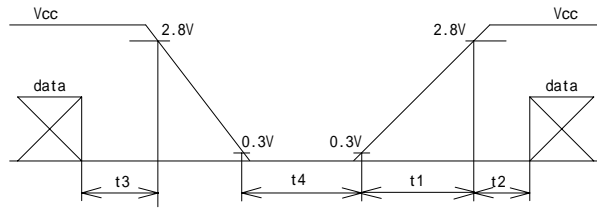
Vcc-dip conditions
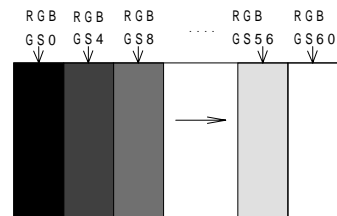
 1)   2.5 V   Vcc   3.0 V

       td   10 ms

 2)   Vcc   2.5 V
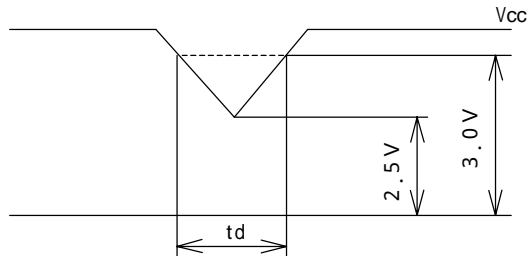
    Vcc-dip conditions should also follow the On-off conditions for supply voltage

Note3   Typical current situation : 16-gray-bar pattern.

      Vcc=+3.3V

6-2. Backlight driving

The backlight system is an edge-lighting type with single CCFT (Cold Cathode Fluorescent Tube).

The characteristics of the lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Lamp current range	I_L	2.0	5.5	6.0	mArms	Note1	
Lamp voltage	V_L		640		Vrms		
Lamp power consumption	P_L		3.52			Note2	
Lamp frequency	F_L	30	50	80	kHz	Note3	
Kick-off voltage	V_S			1300	Vrms	Ta=25	
				1550	Vrms	Ta=0	Note4
Lamp life time	L_L	10000			hour	Note5	

Note1   Lamp current is measured with current meter for high frequency as shown below.
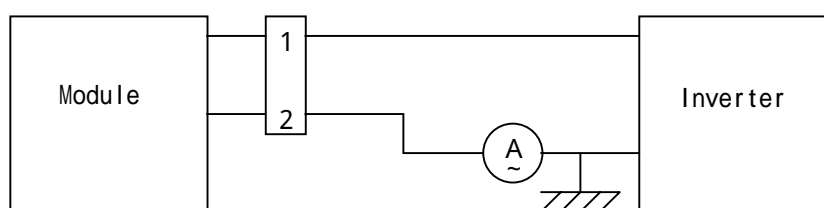
*   pin is V_{LOW}

Note2   Calculated Value for reference ($I_L \times V_L$)

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   It is defined at 22pF for the ballast capacitor of a DC/AC inverter.
The voltage above this value should be applied to the lamp for more than 1 second to start-
up. Otherwise the lamp may not be turned on.

Note5   Lamp life time is defined as the time when either   or   occurs in the continuous
operation under the condition of Ta = 25   and I_L = 6.0mArms.

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

Kick-off voltage at Ta = 0   exceeds maximum value, 1550V rms.

Note)   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.

7. Timing characteristics of input signals

 7-1. Timing characteristics

   (This is specified at digital outputs of LVDS driver.)
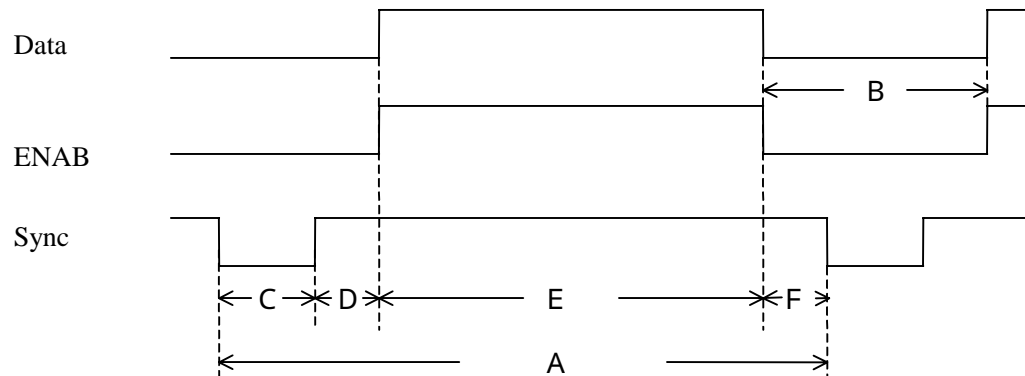
Vertical

Item symbol	Min.	Typ.	Max.	Unit	Remark
Vsync cycle (T_{VA})		16.667		ms	Negative
	803	806		line	
Blanking period(T_{VB})	35	38		line	
Sync pulse width (T_{VC})	4	6		line	
Back porch (T_{VD})	0	29		line	
Sync pulse width + Back porch ($T_{VC}+T_{VD}$)	35	35	35	line	
Active display area (T_{VE})	768	768	768	line	
Front porch (T_{VF})	0	3		line	

(Horizontal)

Item symbol	Min.	Typ.	Max.	Unit	Remark
Hsync cycle (T_{HA})	19.4	20.677		μ s	Negative
	1260	1344	1408	clock	
Blanking period (T_{HB})	236	320		clock	
Sync pulse width (T_{HC})	8	136		clock	
Back porch (T_{HD})	0	160	312	clock	
Sync pulse width + Back porch ($T_{HC}+T_{HD}$)	1500 - T_{HA}	296	T_{HA} - 1024	clock	
Active display area (T_{HE})	1024	1024	1024	clock	
Front porch (T_{HF})	0	24		clock	

Clock

Item	Min.	Typ.	Max.	Unit	Remark
Frequency	50.0	65.0	65.0	MHz	Note1

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

(Hsync-Vsync Phase difference)

Vsync

Hsync

$\rightarrow$|$\leftarrow$ T_{HV}
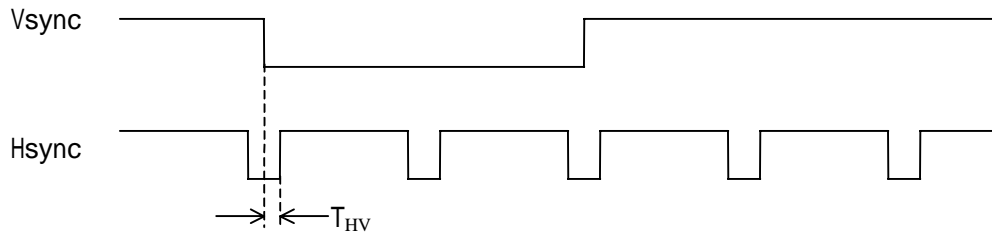
Item(symbol)	Min.	Typ.	Max.		Unit	Remark
Hsync-Vsync Phase difference (T_{HV})	1		T_{HA}	T_{HC}	clock	

(Hsync-ENAB Phase difference)

ENAB

Hsync

T_{HN} $\rightarrow$|$\leftarrow$
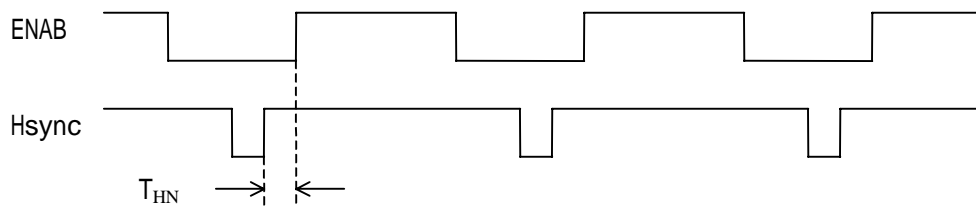
Item	Min.	Typ.	Max.	Unit	Remark
(T_{HN}	0		312	clock	

7-2 Display position

Item	Standards	Beginning	Ending	Unit	Remark
Horizontal	rising edge of ENAB	0	1024	clock	
	falling edge of Hsync	296	1320	clock	Note1
Vertical	falling edge of Vsync	35	803	clock	

Note1   ENAB signal must be fixed to low.

Note
(Horizontal display direction)
    When ENAB is fixed low, 296 clock are counted from Hsync negative edge and data from after are
    available . If you need other timing, please use ENAB signal.
(Vertical display direction)
    35 lines are counted from Vsync negative edge and data from next line are available.
(Note of ENAB signal)
    ENAB could not be used for the purpose of the vertical display start timing.

Caution
    Image will not be displayed on the right position otherwise.

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

Display position of input data

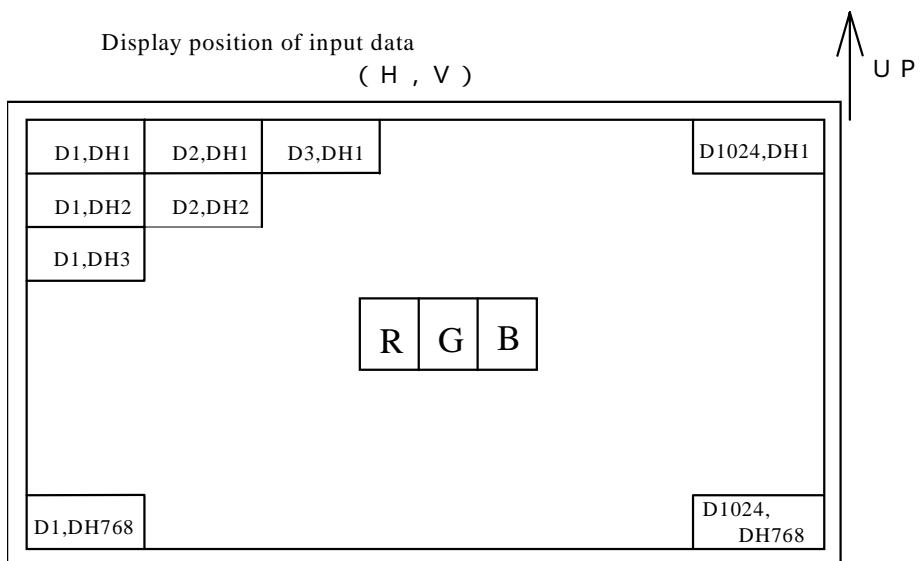| D1,DH1	D2,DH1	D3,DH1		D1024,DH1
D1,DH2	D2,DH2			
D1,DH3				
		R G B		
D1,DH768				D1024, DH768

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

Colors & Gray scale		Data signal																	
Colors & Gray scale	Gray Scale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color Black		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Green		0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Cyan		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Red		1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Magenta		1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
Yellow		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
White		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	↓			↓						↓						↓			
⇩	↓			↓						↓						↓			
Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
⇩	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
⇧	↓			↓						↓						↓			
⇩	↓			↓						↓						↓			
Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
⇩	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
⇧	↓			↓						↓						↓			
⇩	↓			↓						↓						↓			
Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
⇩	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

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

9. Optical Characteristics

Ta=25 , Vcc=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	21，22	CR>10	45			Deg.	Note1,4
	Vertical	11		10			Deg.	
		12		30			Deg.	
Contrast ratio		n	=0°	150				Note2,4
		o	Optimum viewing angle		300			
Response time	Rise	r	=0°		15		ms	Note3,4
	Decay	d			30		ms	
Chromaticity of white					0.313			Note4
					0.329			
Luminance of white Note4				120	150		cd/㎡	$I_L = 6.0_{mArms}$ F_L=50kHz
White Uniformity						1.45		Note5

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.
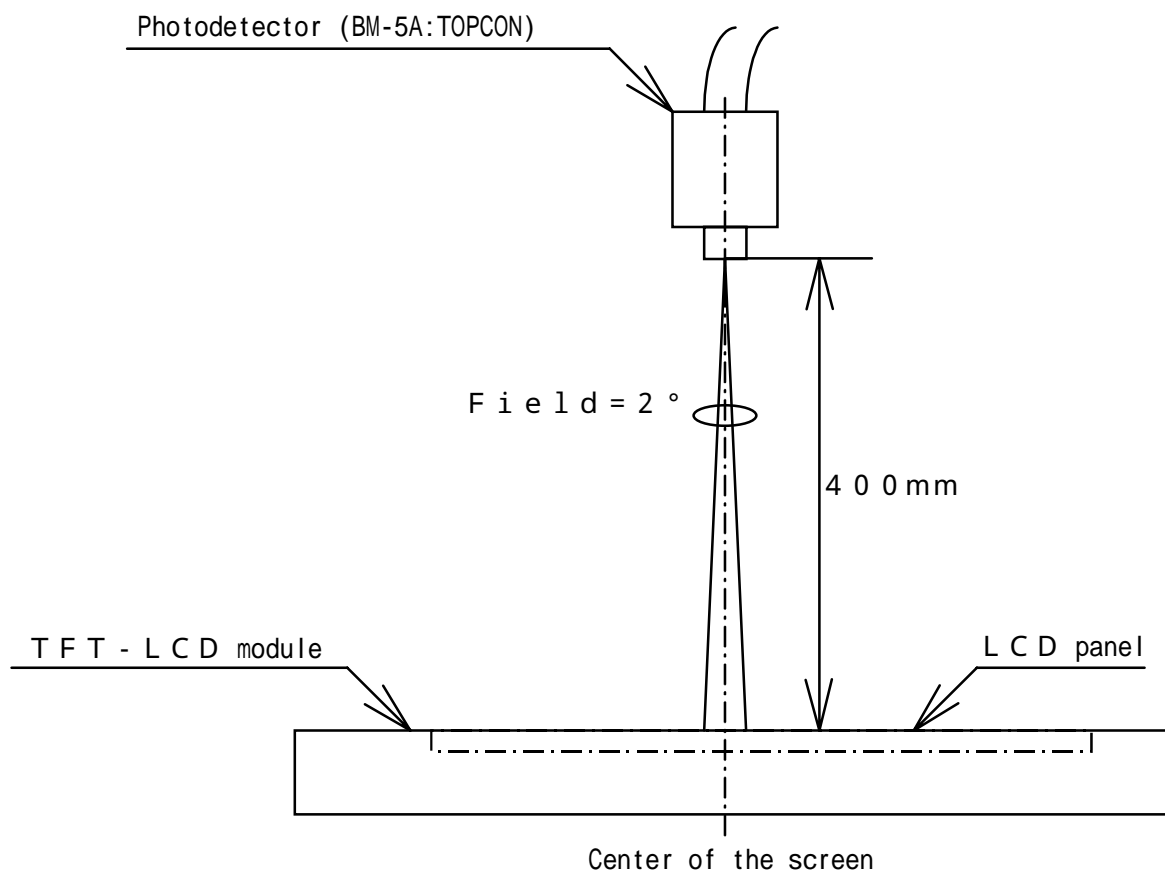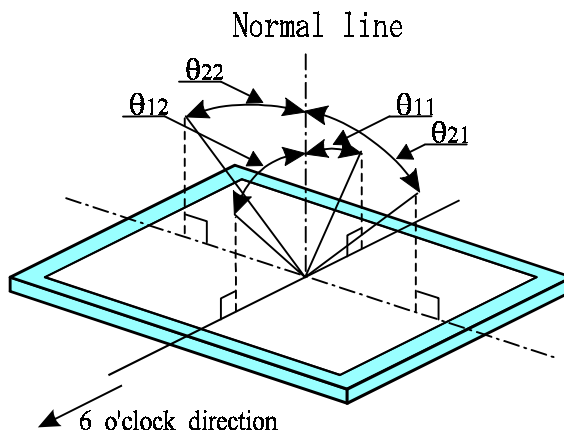

Fig.3 Optical characteristics measurement method

Note1　Definitions of viewing angle range:

Normal line

θ22

θ12

θ11

θ21

6 o'clock direction

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" .

white　　　　black　　　　white

Photodetector output (Relative Value)

100%
90%

10%
0%

τr　　τd

time
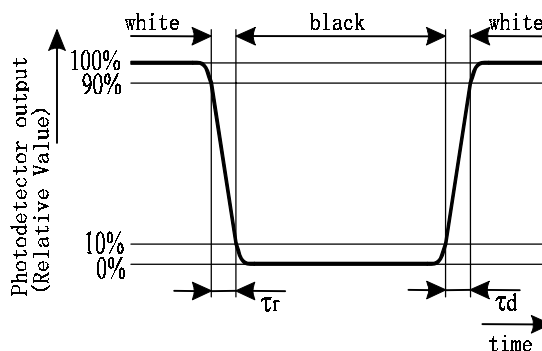
Note4　This shall be measured at center of the screen.

Note5　Definition of white uniformity:

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

256　　512　　768　pixel

192

384

576
Pixel
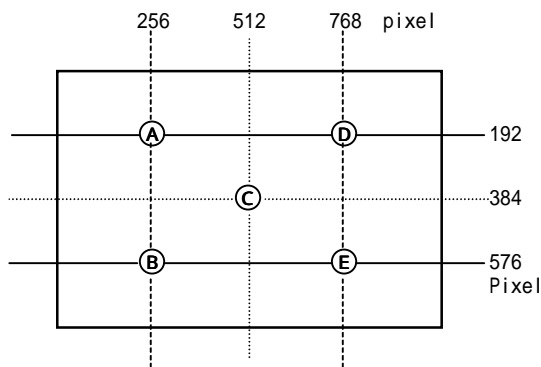
$$W = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

10. Display Quality

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.

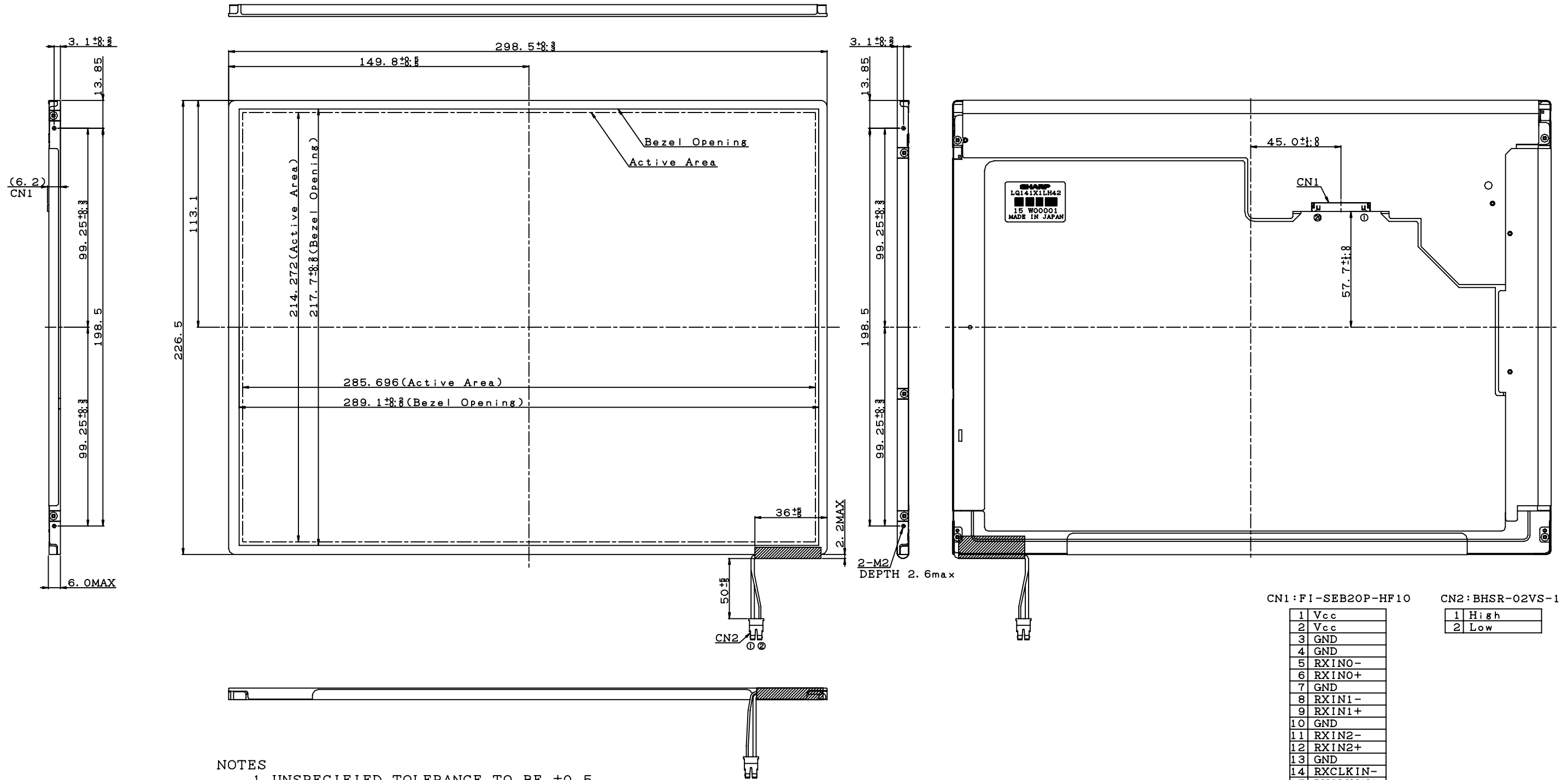b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

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) Observe all other precautionary requirements in handling components.

i) This module has its circuitry PCBs on the rear side and should be handled carefully in order not to be stressed.

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 blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc..

k) Duaring the module aging , don't put protection film on the module surface.

l) 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.

12. Packing form

a) Piling number of cartons : MAX.5

b) Package quantity in one carton : 10pcs

c) Carton size : 434(W)× 353 (D)× 291(H)mm

d) Total mass of one carton filled with full modules : 6600 g

Packing form is shown in Fig.2

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 (No condensation)
4	High temperature operation test	Ta = 50 240h (The panel temp. must be less than 60)
5	Low temperature operation test	Ta = 0 240h
6	Vibration test (non- operating)	Frequency : 10 57Hz/Vibration width (one side):0.075mm : 58 500Hz/Gravity:9.8m/s^2 Sweep time : 11 minutes Test period : 3 hours (1 hour for each direction of X,Y,Z)
7	Shock test (non- operating)	Max. gravity : 490 m/s^2 Pulse width : 11 ms, sine wave Direction : ± X,± Y,± Z once for each direction.

14   Others

1) Lot No. Label:

— Model No.
— Barcode (Lot No.)
— Lot No.

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.1 Outline Dimension

CN1:FI-SEB20P-HF10

1	Vcc
2	Vcc
3	GND
4	GND
5	RXIN0-
6	RXIN0+
7	GND
8	RXIN1-
9	RXIN1+
10	GND
11	RXIN2-
12	RXIN2+
13	GND
14	RXCLKIN-
15	RXCLKIN+
16	GND
17	RESERVED
18	RESERVED
19	GND
20	GND

CN2:BHSR-02VS-1

1	High
2	Low

CN1:FI-SEB20P-HF10(JAE)
CN2:BHSR-02VS-1(JST)

NOTES
1. UNSPECIFIED TOLERANCE TO BE ±0.5
2. WARP AND FLATING FOR
   PCB AND CHASSIS ARE EXCLUDED FROM
   THICKNESS AND DIMENSION OF THE UNIT.

D/N:2D-015-625-00

Top Tray

TFT-LCD Module

Sleeve Tray

Tray

Master Carton

OPP Tape

PP Band

Fig.2 Packing Form