PREPARED BY: DATE	SHARP	SPEC No. LD-6801A
		FILE No.
APPROVED BY: DATE	LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION	ISSUE: Aug. 31. 1994
		PAGE : 16 pages
	SPECIFICATION	APPLICABLE GROUP Liquid Crystal Display Group

DEVICE SPECIFICATION FOR

TFT-LCD module

MODEL No.

LQ10D131

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED BY H. Fukuoka

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SHARP CORPORATION

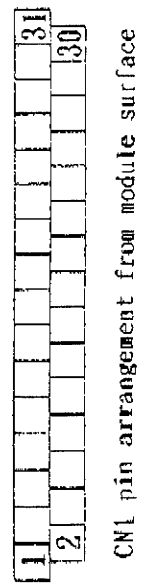
4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (Interface signals)

Used connector: DF9L-31P-1V (Hirose Electric Co., Ltd.)
Corresponding connector: DF9 -31S-1V (")
DF9A-31S-1V (")
DF9B-31S-1V (")

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



CN1 pin arrangement from module surface

※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 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) Don't use ENAB signal fixed "High".

RECORDS OF REVISION

SPEC No.	DATE	REVISED No.	PAGE	SUMMARY	NOTE
LD-6801	–	–		—	1st Issue
LD-6801A	SEP. 22. 1994	A	2	4. Input Terminals 【Note2】 (added)	2nd Issue
			11	9. Optical Characteristics	
				Luminance of white(Y_L) Min. 50 cd/m^2	(added)

1. Application

This specification applies to color TFT-LCD module, LQ10D131.

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 640×3×480 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
Display size	26 (10.4") Diagonal	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 *1	242.5(W)×179.4(H)×11.5(D)	mm
Weight	500±10	g
Surface treatment (Haze)	Anti-glare and hard-coating 2H ($25^{\pm 5}$)	(%)

*1. With the exception of the backlight connector, electric parts and rear cover.

Outline dimensions is shown in Fig.1

4-2. Backlight driving

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

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

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	—	0 ～ +50	℃	

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

【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
+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_{OL}	—	—	1.0	μA	V_I=0V 【Note3】
Input current (High)		I_{OH1}	—	—	1.0	μA	V_I=Vcc 【Note4】
		I_{OH2}	—	—	60.0	μA	V_I=Vcc 【Note5】

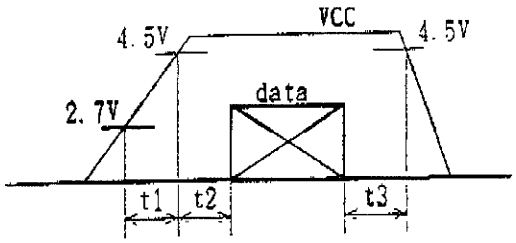
【Note1】

Vcc-turn-on conditions

t1≦10ms

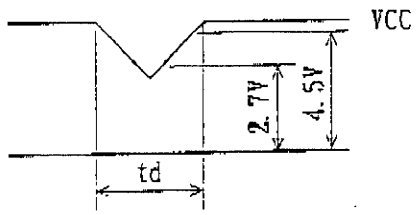
0<t2≦10ms

t3>0ms



Vcc-dip conditions

1) 2.7V ≦ Vcc < 4.5V
   td ≦ 10ms
2) Vcc < 2.7V
   Vcc-dip conditions shoud also follow the Vcc-turn-on conditions



【Note2】 Typical current situation : Black pattern. (at 480 line mode, V_{cc}=+5.0V)

【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 driving

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

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

Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp voltage	V_L	–	540	–	Vrms	Just for reference
Lamp current	I_L	2.5	3.7	4.5	mArms	【Note1】
Lamp power consumption	P_L	–	2.0	–	W	【Note2】
Lamp frequency	F_L	20	–	60	kHz	【Note3】
Kick-off voltage	V_S	–	–	1100	Vrms	Ta=25℃
		–	–	1300	Vrms	Ta=0℃
Lamp life time	L_L	10000	–	–	h	【Note4】

【Note1】 Available current range considering light-adjustment.

【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 its harmonics to avoid interference.

【Note4】 Brightness becomes 50% of the original value under standard condition. (I_L=3.7mArms)

Note) The turn-on characteristcs and the life of the backlight depend greatly on the inverters characteristics as a power source. Before you order the inverters from vendors, make sure that the ill-lighting like flickering, not-being-turned-on or else will not occur because of the un-adjustment between the inverter and the backlight. It is recommended that the trial conditions for above confirmation should be as close to the practical situation as they can be.

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	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	
			"	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 setlled 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

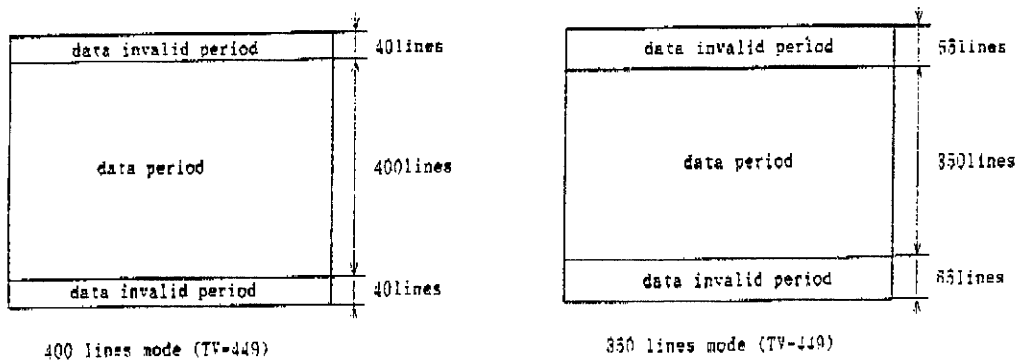
If sinc. signals have the polarity discribed in 4-1 (Note1) and have values shown in the following table, the vertical display position is automatically centered at each mode of VGA : 480 line, 400 line and 350 line.

In 400 and 350 line modes, the display position will not be centered on the screen if the cycle of vertical synchronous signal, TV, deviates from typical values.

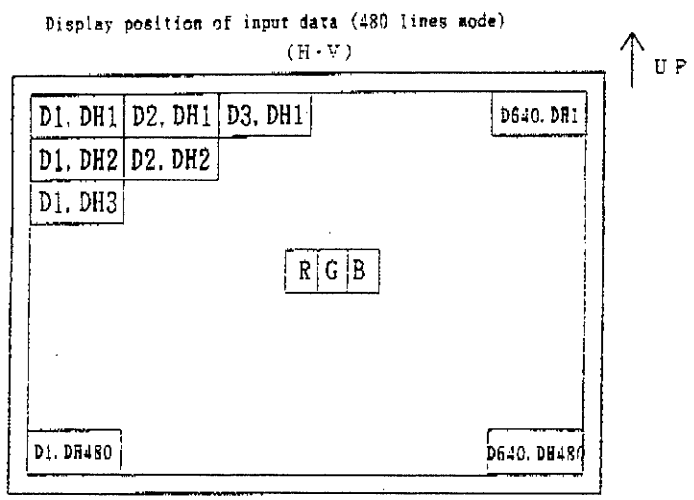
The data enable signal has no relation to the vertical display position.

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 the vertical data invalid period is displayed in 400 and 350 line modes, inputting all data "0" is recommended during vertical data invalid period. (refer to the following figure)



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



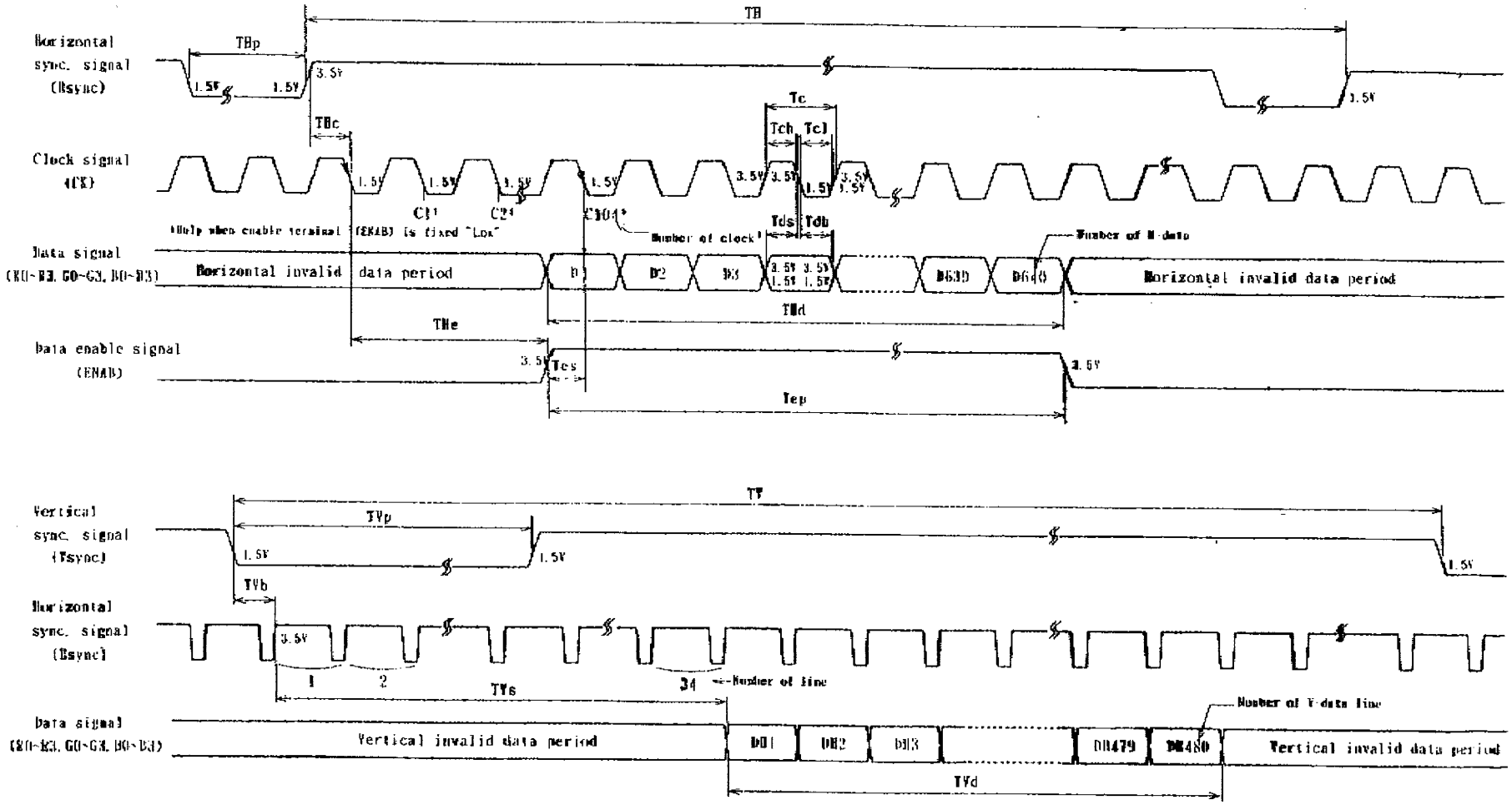


Fig. 2-0 Input signal waveforms (480 line mode)

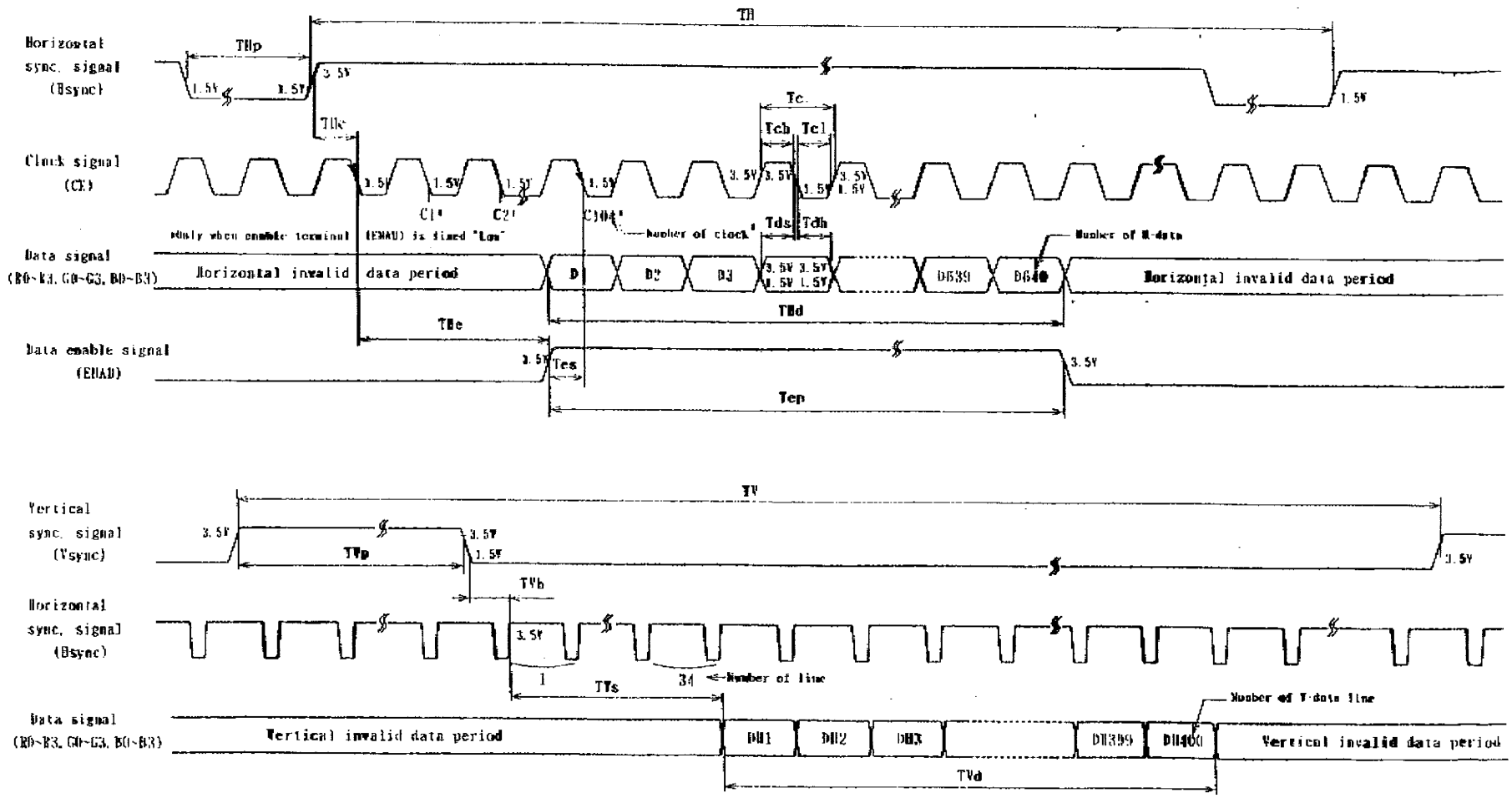


Fig. 2-6 Input signal waveforms (400 line mode)

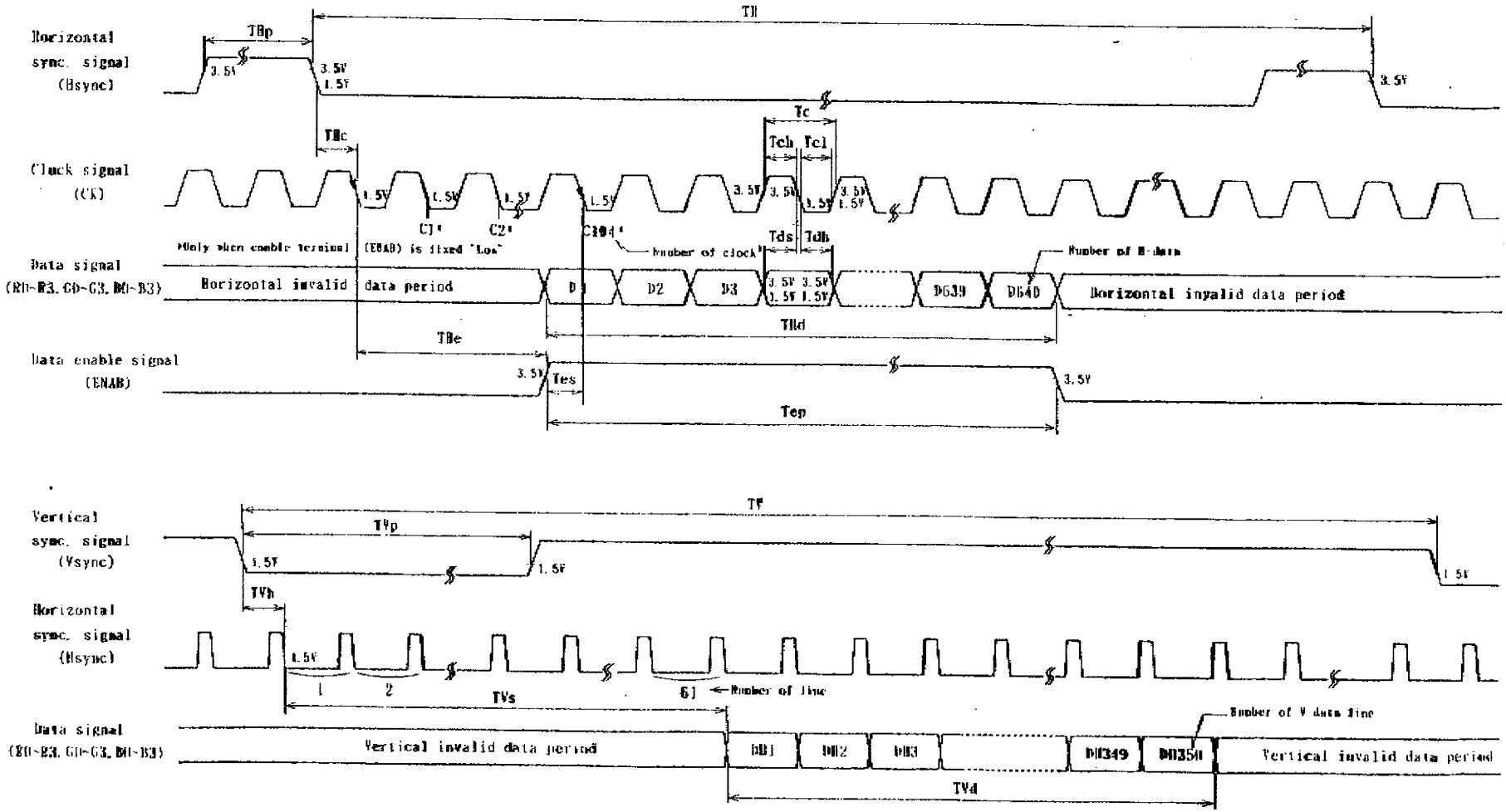


Fig. 2-6 Input signal waveforms (350 line mode)

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 color is displayed in 16 gray scales from 4 bit data signals input.
According to the combination of total 12 bit data, 4,096 colors are displayed.

9. Optical Characteristics

Ta=25℃. Vcc=+5V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21. 22	CR > 10	35	–	–	Deg.	【Note1. 4】
	Vertical	θ 11		10	–	–	Deg.	
		θ 12		30	–	–	Deg.	
Contrast ratio		CR	Optimum viewing angle	60	–	–		【Note2. 4】
Response time	Rise	τ r	θ =0°	–	30	–	ms	【Note3. 4】
	Decay	τ d		–	50	–	ms	
Chromaticity of white		x		–	0. 313	–		【Note4】
		y		–	0. 329	–		
Luminance of white		Y_L		50	70	–	cd/m^2	
White Uniformity		δ w		–	–	1. 45		【Note5】

※The measurement shall be executed 15~20 minutes after lighting at rating.
The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig. 3 below. (I_L=3. 7mArms)

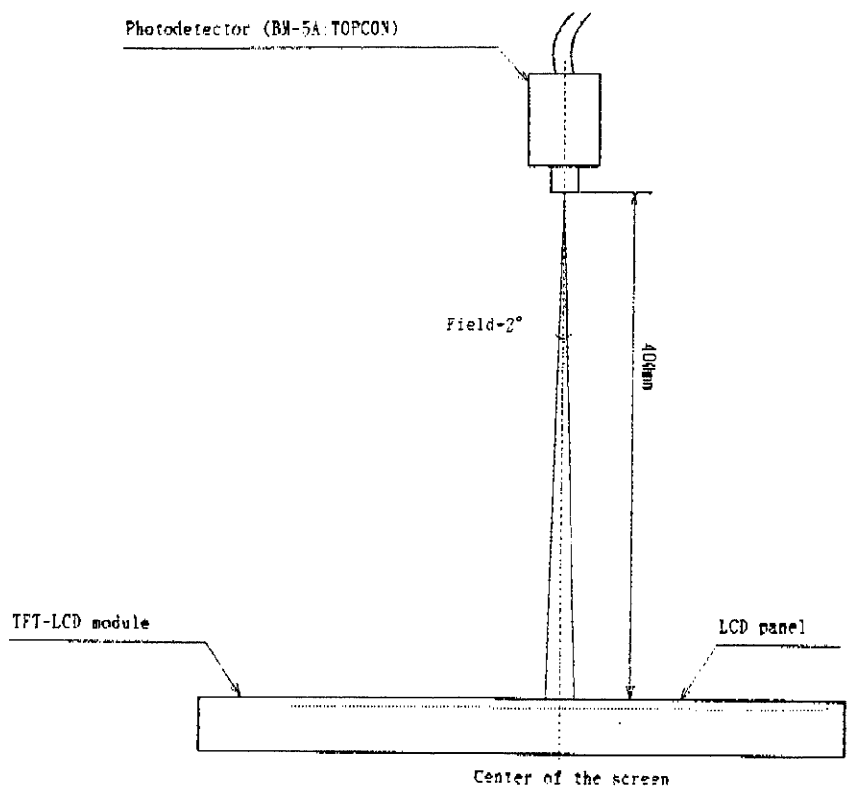
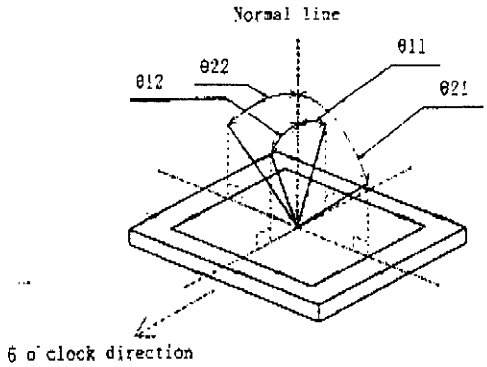


Fig. 3 Optical characteristics measurement method

【Note1】 Definitions of viewing angle range:



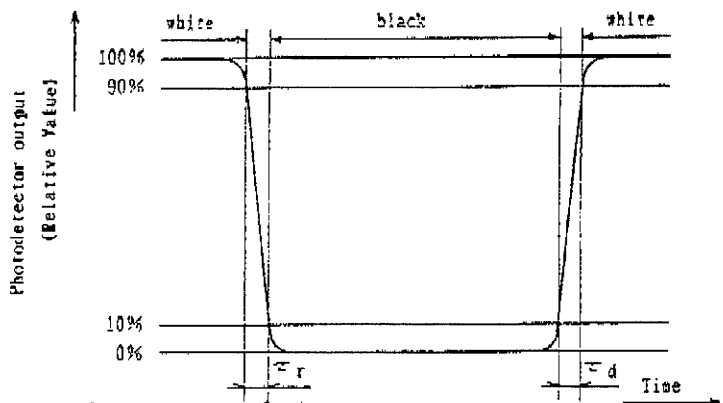
【Note2】 Definition of contrast ratio:

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】 Definitions 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".

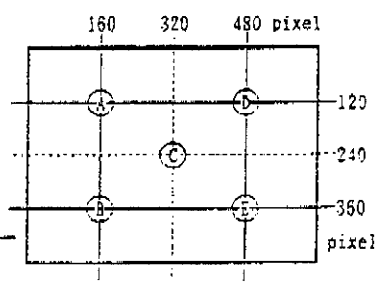


【Note4】 This shall be measured at center of the screen.

【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 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.

11-2. 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 injure the 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.

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 : 7000g

Packing form is shown 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 (No condensation)
4	High temperature operation test	Ta=50℃ 240h
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 : 490m/s^2 Pulse width : 11ms. sine wave Direction : ±X.±Y.±Z once for each direction.

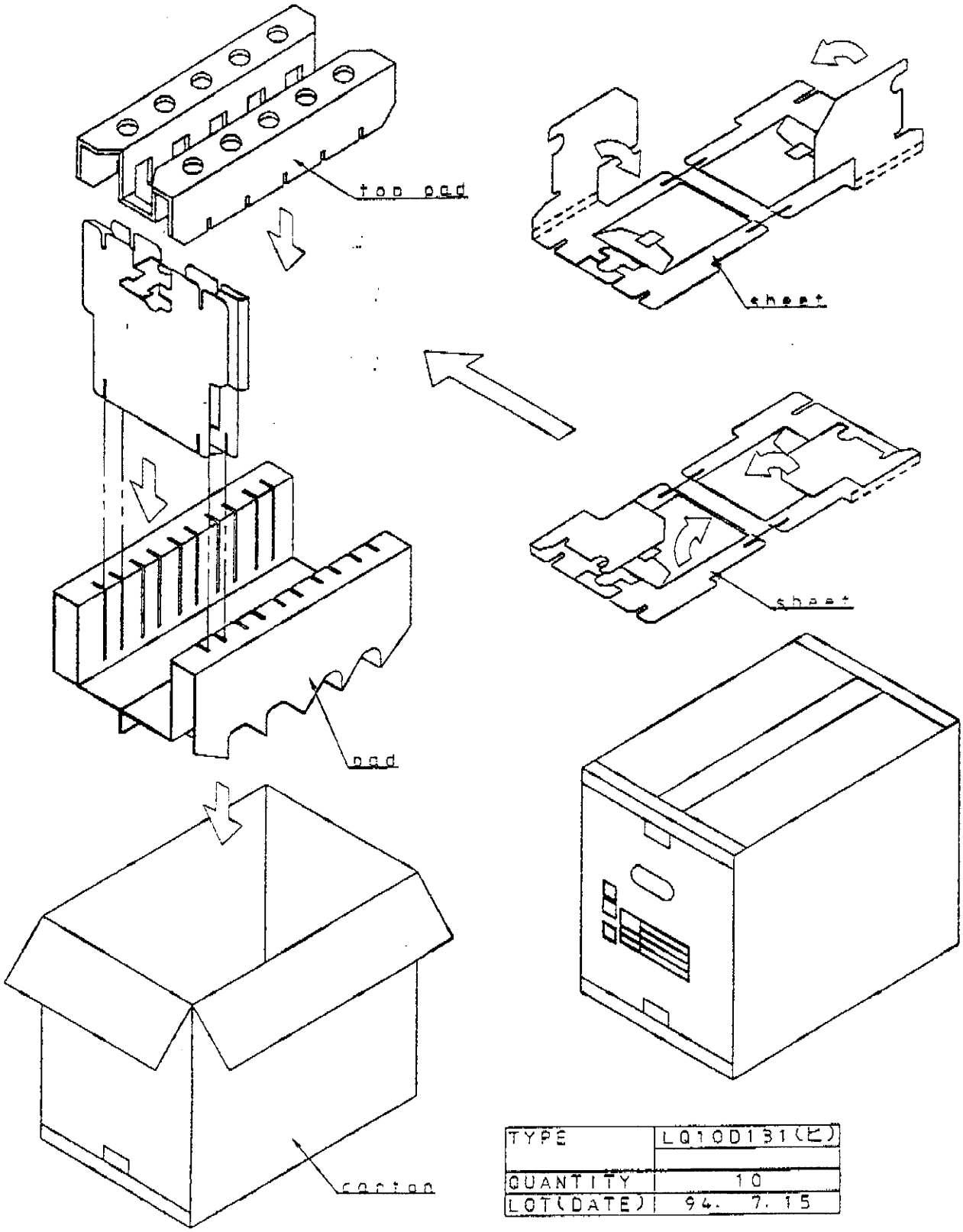
【Result Evaluation Criteria】

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

14. Others

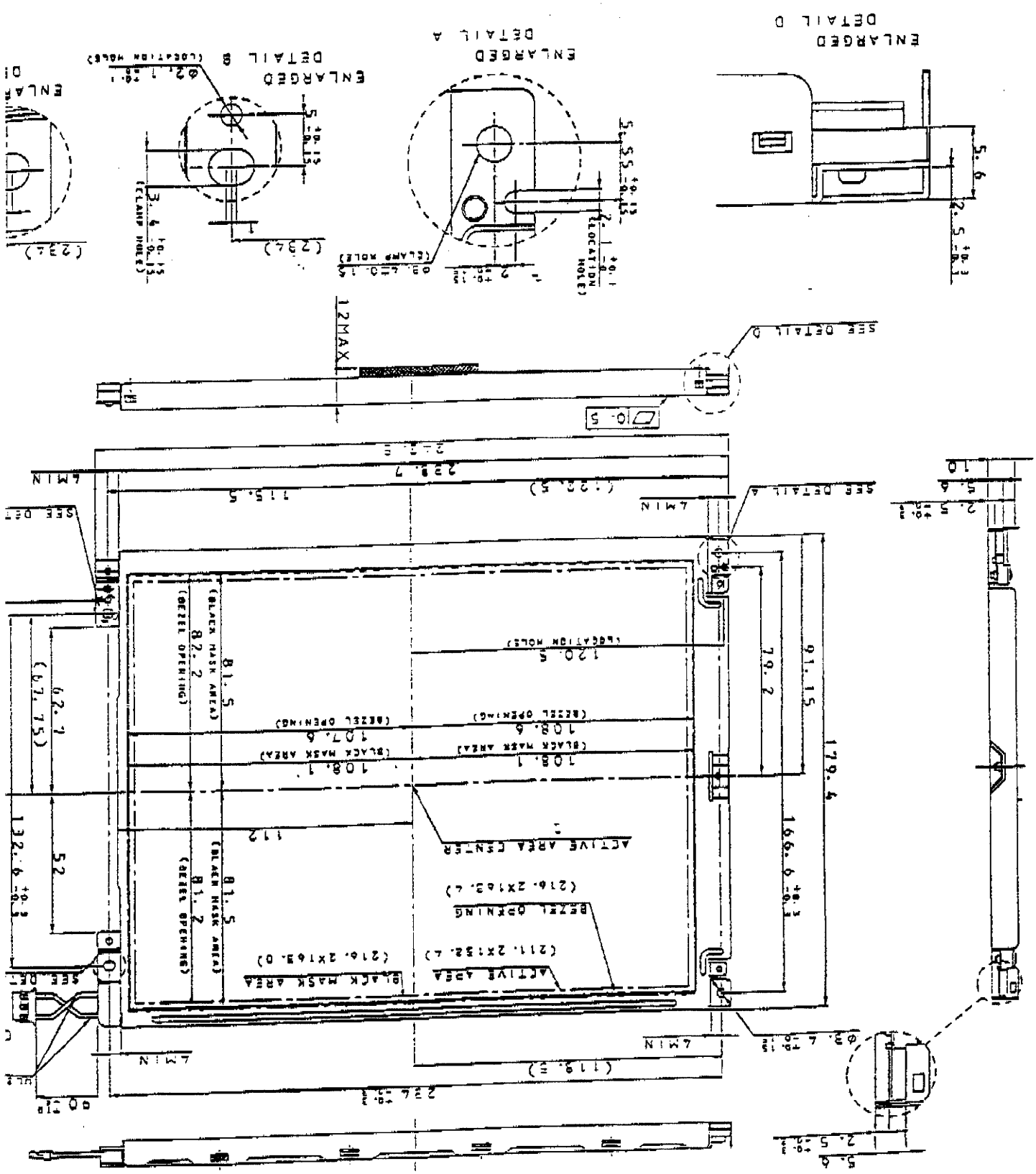
1) Lot No. Label:

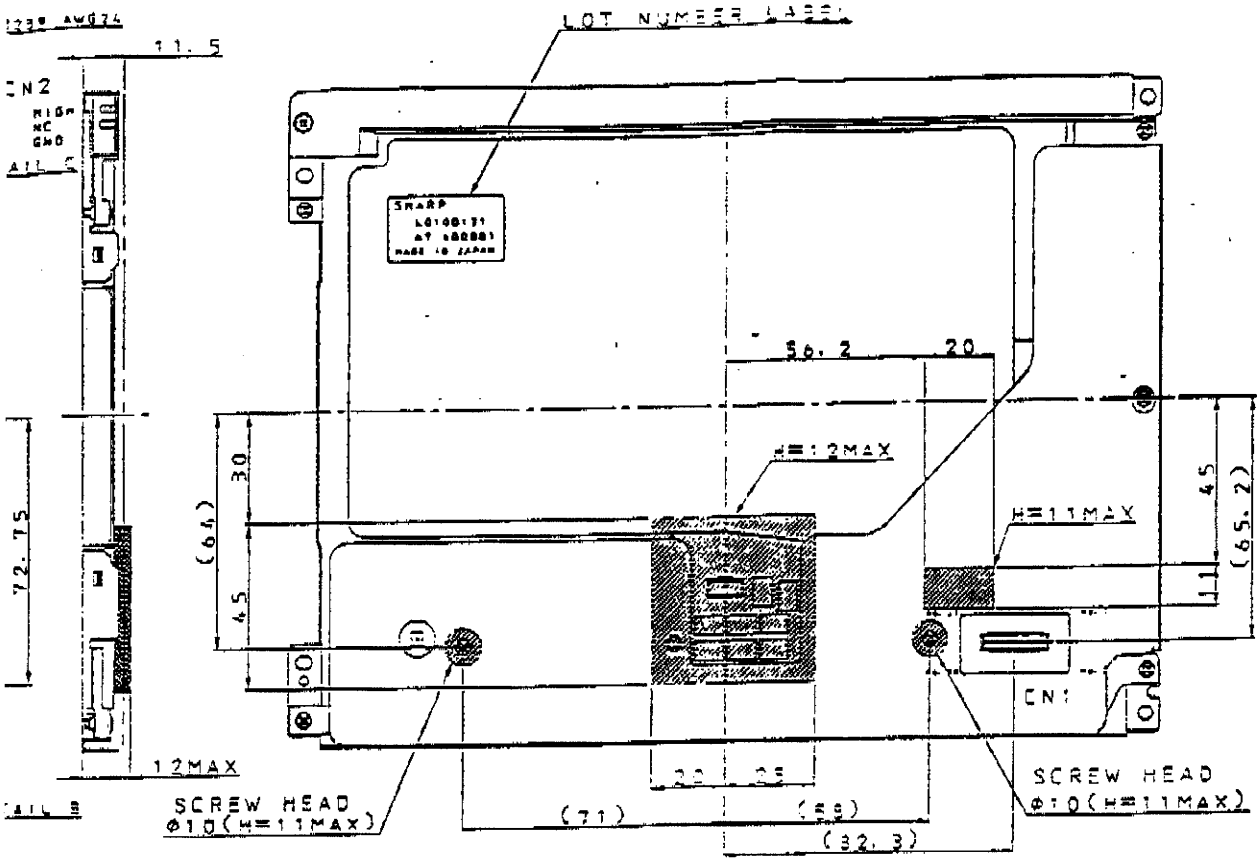
2) Adjusting volume have been set optimally before shipment. so do not change any adjusted value. If adjusted value is changed. the data mentioned in these specifications literature may not be satisfied.
3) Disassembling the module can cause permanent damage and should be strictly avoided.
4) Please 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 these specifications literature. it shall be resolved through discussion with spirit of cooperation.

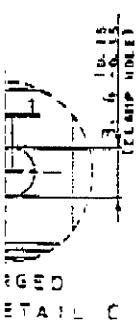


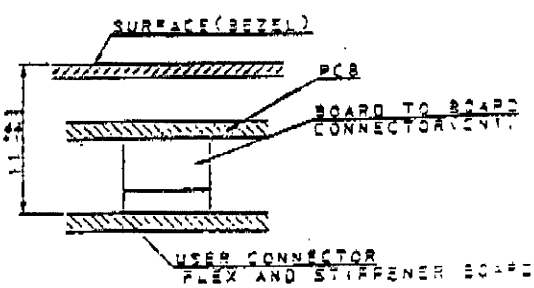
TYPE	LQ10D131(E)
QUANTITY	10
LOT(DATE)	94. 7. 15

fig.4 packing form

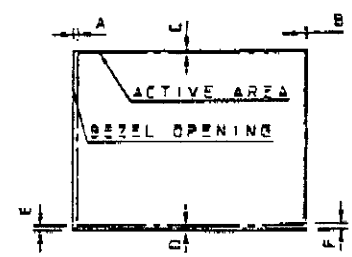

ENLARGED DETAIL D
ENLARGED DETAIL A
ENLARGED DETAIL B
12MAX
SEE DETAIL D
SEE DETAIL A
4MIN
ACTIVE AREA CENTER
ACTIVE AREA
BLACK MASK AREA
BEZEL OPENING
(LOCATION HOLE)
(BLACK MASK AREA)
(BEZEL OPENING)
179.4
166.6
132.6
91.15
79.2
62.7
52







BEZEL/DISPLAY POSITION



1) TOLERANCE X-DIRECTION A: 3.0±0.8
2) TOLERANCE X-DIRECTION B: 2.0±0.8
3) TOLERANCE Y-DIRECTION C: 2.0±0.8
4) TOLERANCE Y-DIRECTION D: 3.0±0.8
5) OBLIQUITY OF DISPLAY AREA |E-F|<0.8

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