PRODUCT SPECIFICATIONS

SHARP

AVC Liquid Crystal Displays Group

LQ104V1DC31

TFT-LCD Module

Spec. Issue Date: December 13, 2005

No: LD-12604B

PREPARED BY : DATE	SHARP	SPEC No. LD-12604B
		FILE No.
APPROVED BY : DATE		ISSUE : Jun. 15.2000
		PAGE : 17 pages
	AVC LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION SPECIFICATION	APPLICABLE GROUP AVC LIQUID CRYSTAL DISPLAY GROUP

REVISION: DEC. 13. 2005

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ104V1DC31

These parts have corresponded with the RoHS directive.

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

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1. Application

This specification applies to color TFT-LCD module, LQ104V1DC31
(This specification is only applied for the module which has letter "A" at the end of the lot number of the module.)

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 .

SHARP assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specification sheets .

Contact and consult with a SHARP sales representative for any questions about this device .

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. 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 .

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.

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)×11.2max(D)	mm
Mass	310(max)	g
Surface treatment	Anti-glare and hard-coating 3H	

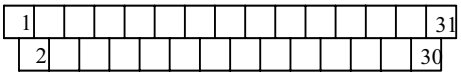
*1.Note: excluding backlight cables.

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】

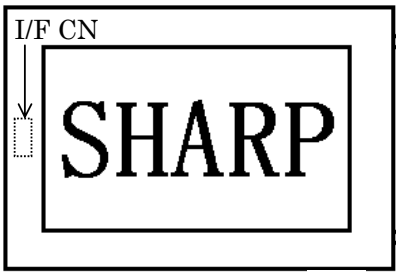
※The shielding case is not connected with GND.

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

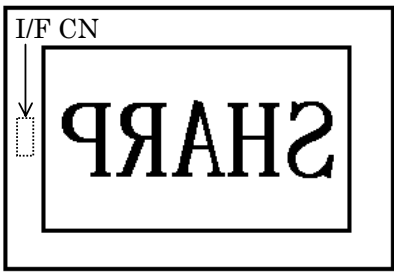
Mode	480 lines	400 lines	350 lines
Hsync	Negative	Negative	Positive
Vsync	Negative	Positive	Negative

【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】【Note4】



R／L＝Ｈｉｇｈ、U／D＝Ｌｏｗ



R／L＝Ｌｏｗ、U／D＝Ｌｏｗ

R／L＝Ｈｉｇｈ、U／D＝Ｈｉｇｈ

R／L＝Ｌｏｗ、U／D＝Ｈｉｇｈ

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 ①	Topp	－	-10～+70	℃	【Note3】
Operating temperature ②	Top	－	-10～+65	℃	【Note4】
Light source wave length	λI	－	≧400	nm	【Note5】
Light source luminance	－	－	≦14000	cd/m^2	【Note5】

【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.

【Note3】Panel surface temperature

【Note4】Module ambient temperature

【Note5】Measurement point：panel surface (Backlight mounting side)

The light source used fluorescence lamp with three wave length.

6. Electrical Characteristics

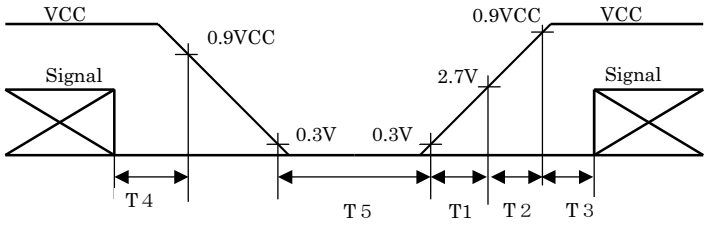
6-1.TFT-LCDpaneldriving

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	270	mA	Vcc=3.3V【Note2】
		Icc	—	150	230	mA	Vcc=5.0V【Note2】
Permissive input ripple voltage		V_{RF}	—	—	100	mVp-p	
Input voltage (Low)		V_{IL}	—	—	0.3Vcc	V	【Note3】
Input voltage (High)		V_{IH}	0.7Vcc	—	—	V	
Input current (low)		I_{OL1}	—	—	1.0	μA	V_I=0V 【Note4】
		I_{OL2}			10	μA	V_I=0V 【Note5】
		I_{OL3}	-	-	800	μA	V_I=0V 【Note6】
Input current (High)		I_{OH1}	—	—	1.0	μA	V_I=Vcc【Note7】
		I_{OH2}			300	μA	V_I=Vcc【Note8】
		I_{OH3}	—	—	800	μA	V_I=Vcc【Note9】

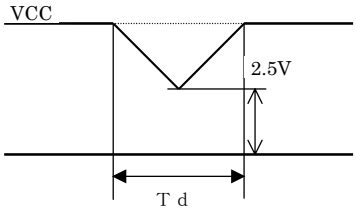
【 NOTE 1】
Vcc-turn-on conditions

０＜Ｔ１≦１５ｍｓ
０＜Ｔ２≦１０ｍｓ
０＜Ｔ３≦１００ｍｓ
０＜Ｔ４≦１ｓ
Ｔ５＞２００ｍｓ

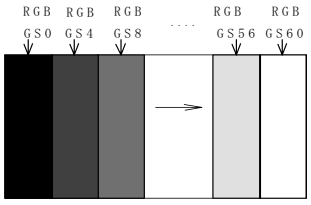


Vcc-dip conditions

１）２．５V≦Ｖｃｃ
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,

【Note5】 U/D,ENAB

【Note6】 R/L

【Note7】 CK,R0~R5,G0~G5,B0~B5,Hsnc,Vsync,R/L

【Note8】 ENAB

【Note9】 U/D

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

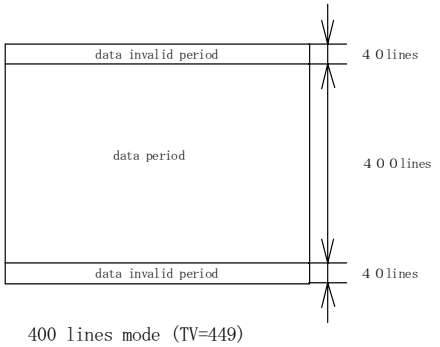
The vertical display position is automatically centered in the active area at each mode of VGA ,480-,400-,and 350-line mode . Each mode is selected depending on the polarity of the synchronous signals described in 4-1(Note1).

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.

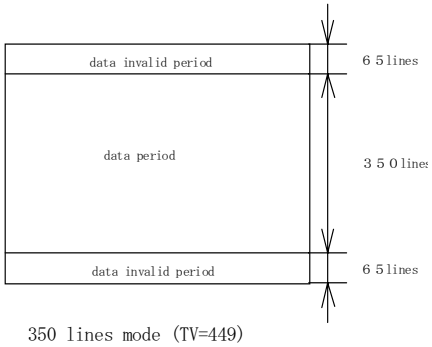
In 400-,and 350-line mode,the data in the vertical data invalid period is also displayed, So ,inputting all data "0" is recommended during vertical data invalid period.

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	

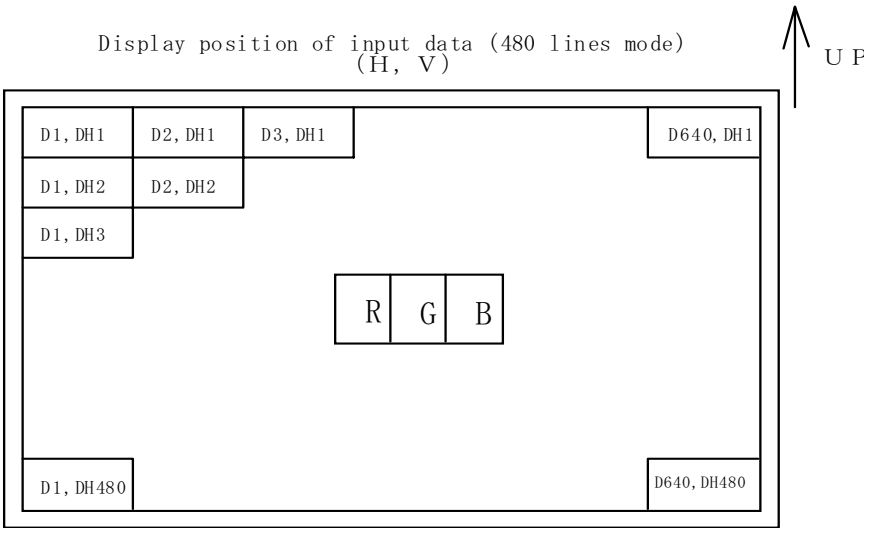


400 lines mode (TV=449)



350 lines mode (TV=449)

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



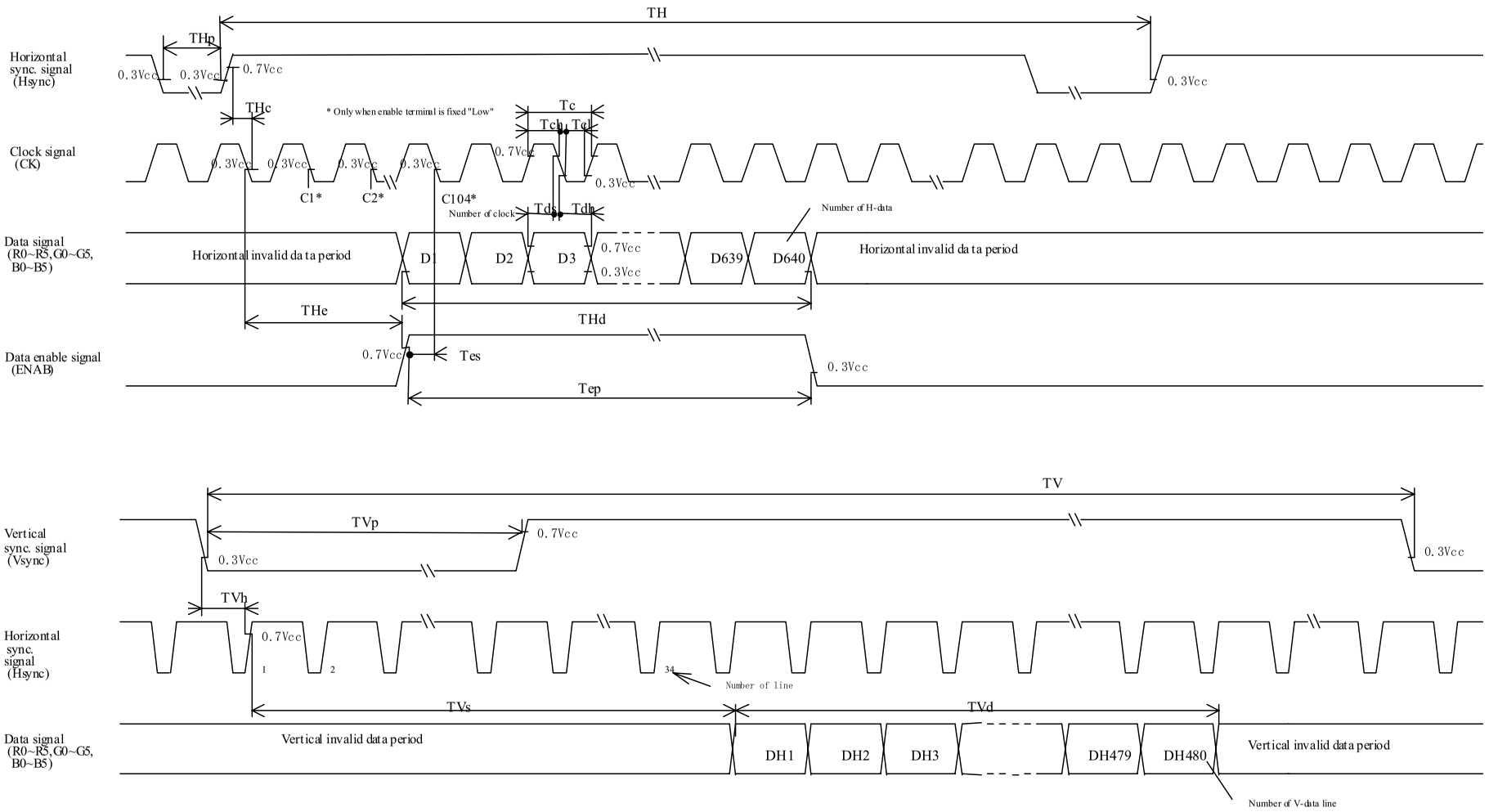


Fig 2-1 Input signal waveforms (480 line mode)

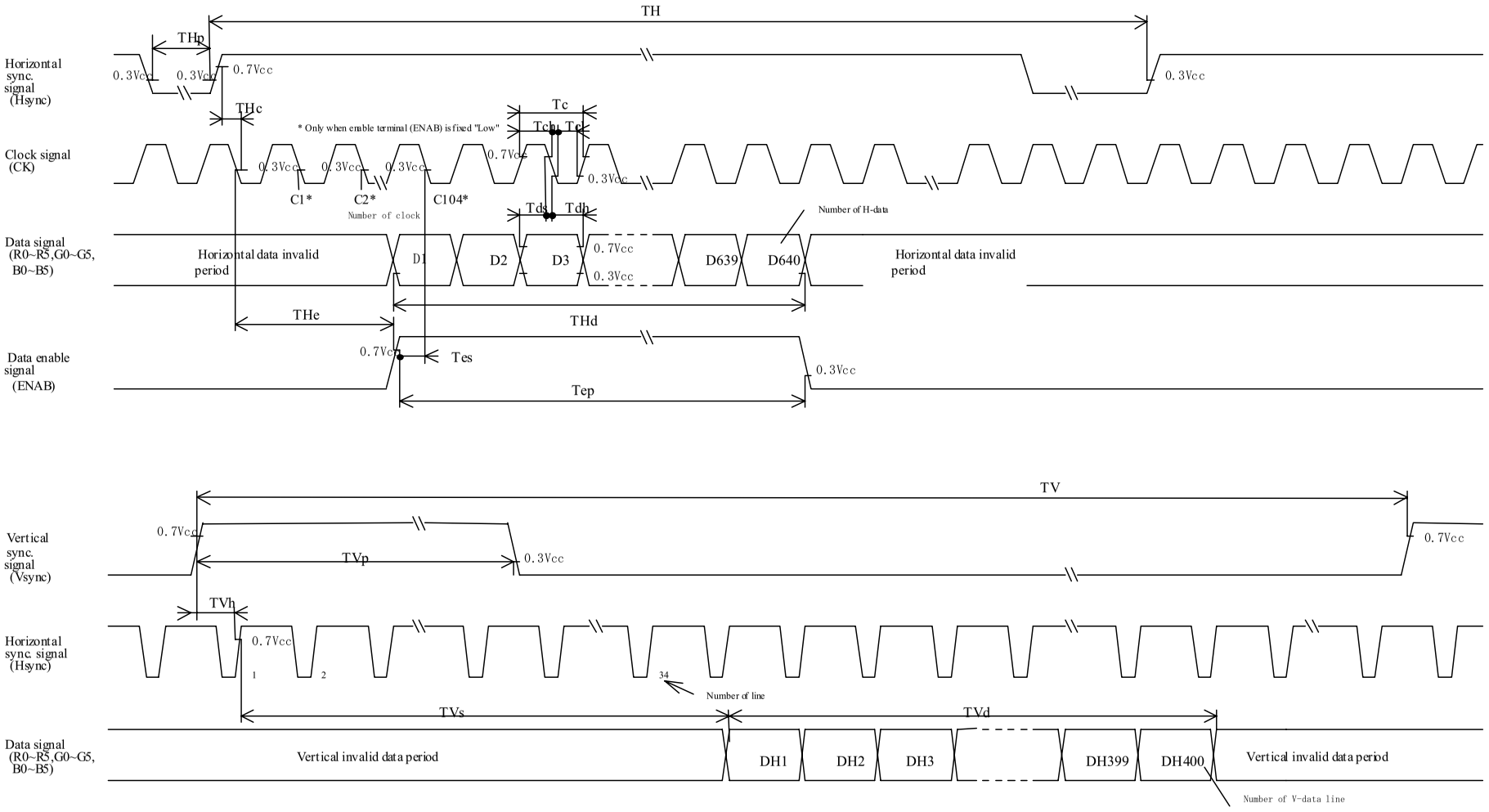


Fig.2-2 Input signal waveforms (400 line mode)

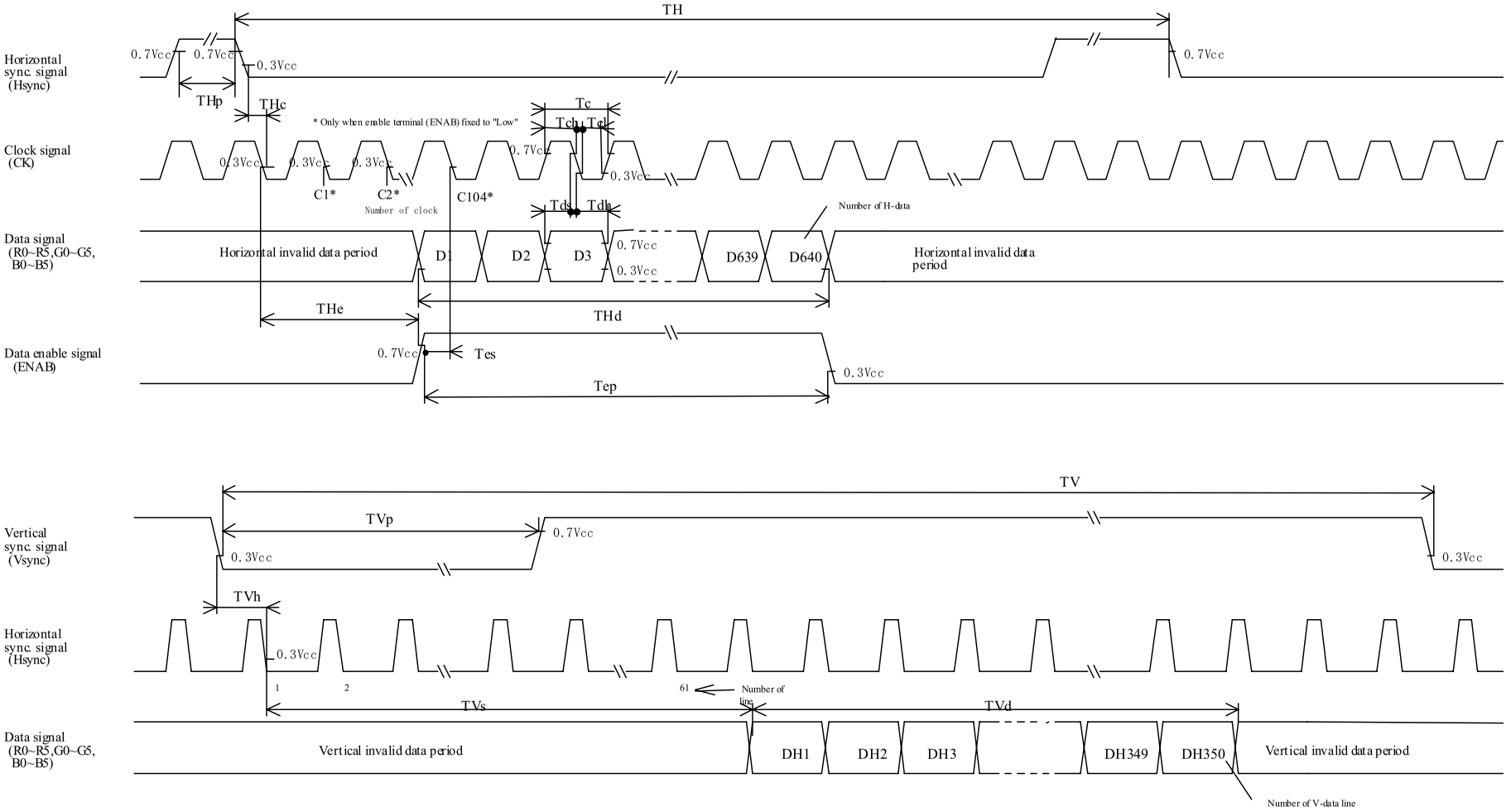


Fig.2-3 Input signal waveforms (350 line mode)

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

	Colors & Gray scale	Data signal																	
		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

(It is usually required to measure under the following condition.condition:IL=6.0mA,Ta=25℃±2℃,FL=60kHz.)

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】
			Optimum Viewing Angle	—	300	—	—	
Response Time	Rise	τr	θ=0°	—	20	—	ms	【Note3,4】
	Decay	τd		—	40	—	ms	
Chromaticity of White		x		—	0.305	—		【Note4】
		y		—	0.329	—		
Transmissivity		tr		6.1	7.7	—	%	【Note5】

[Use the backlight of LQ10D421 for measurement]

※The measurement shall be executed 30 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.

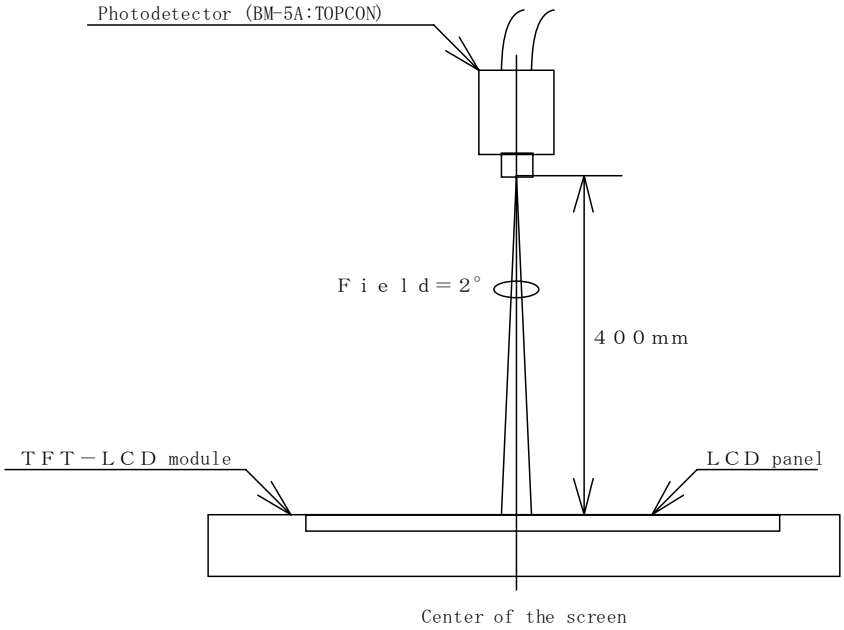
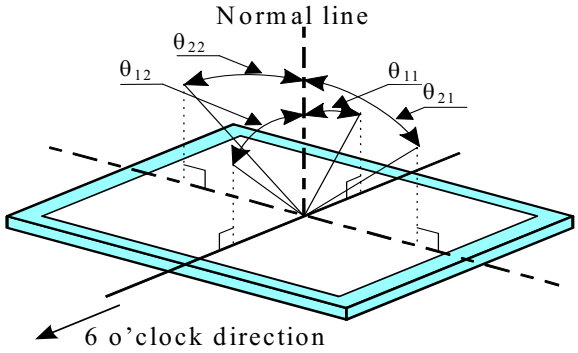


Fig.3 Optical characteristics measurement method

【Note1】Definitions of viewing angle range:



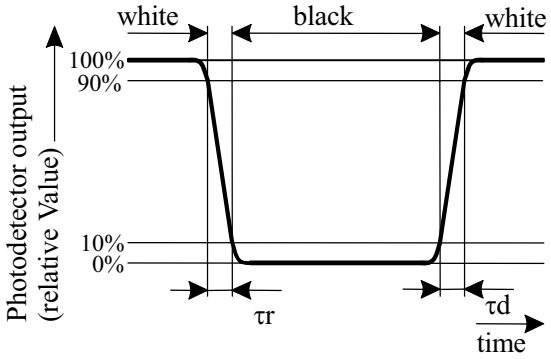
【Note2】Definition of contrast ratio:

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:

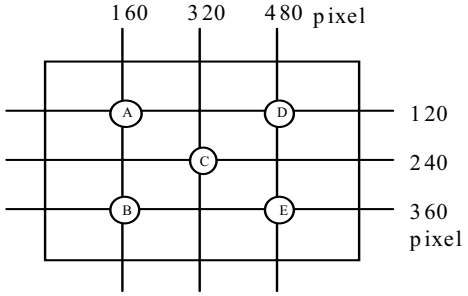
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



【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 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 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.Observe all other precautionary requirement in handling electric components.
h) Protection 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 '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 be attached when LCD panel is used under such environment.
k)When you use the module , please apply enough EMI countermeasure by using optimum backlight sysutem etc..
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.
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) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is used under such environment.
o) When install LCD modules in the cabinet, recommended torque value is “0.294±0.02N·m (3.0±0.2kgf·cm)”.
Be sure to confirm it in the same condition as it is installed in your instrument.
p) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
q) Notice:Never dismantle the module , because it will cause failure.
r) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
s) 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.
t) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

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	10kg
Packing form is shown	Fig.4

13. Reliability test items

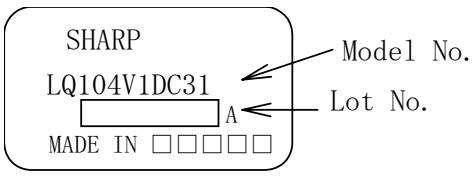
No.	Test item	Conditions
1	High temperature storage test	Ta=70℃ 240h
2	Low temperature storage test	Ta= -30℃ 240h
3	High temperature & high humidity operation test	Ta=40℃ ; 95%RH 240h (No condensation)
4	High temperature operation test	Topp=70℃ 240h(Panel surface temperature)
5	Low temperature operation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

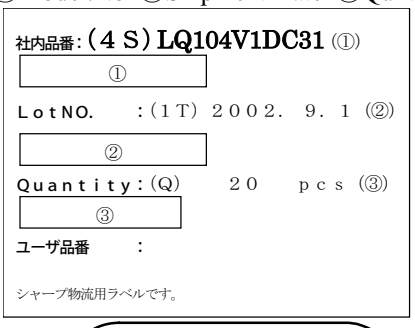
14. Others

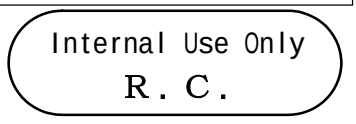
1) Label: Module



Packing box

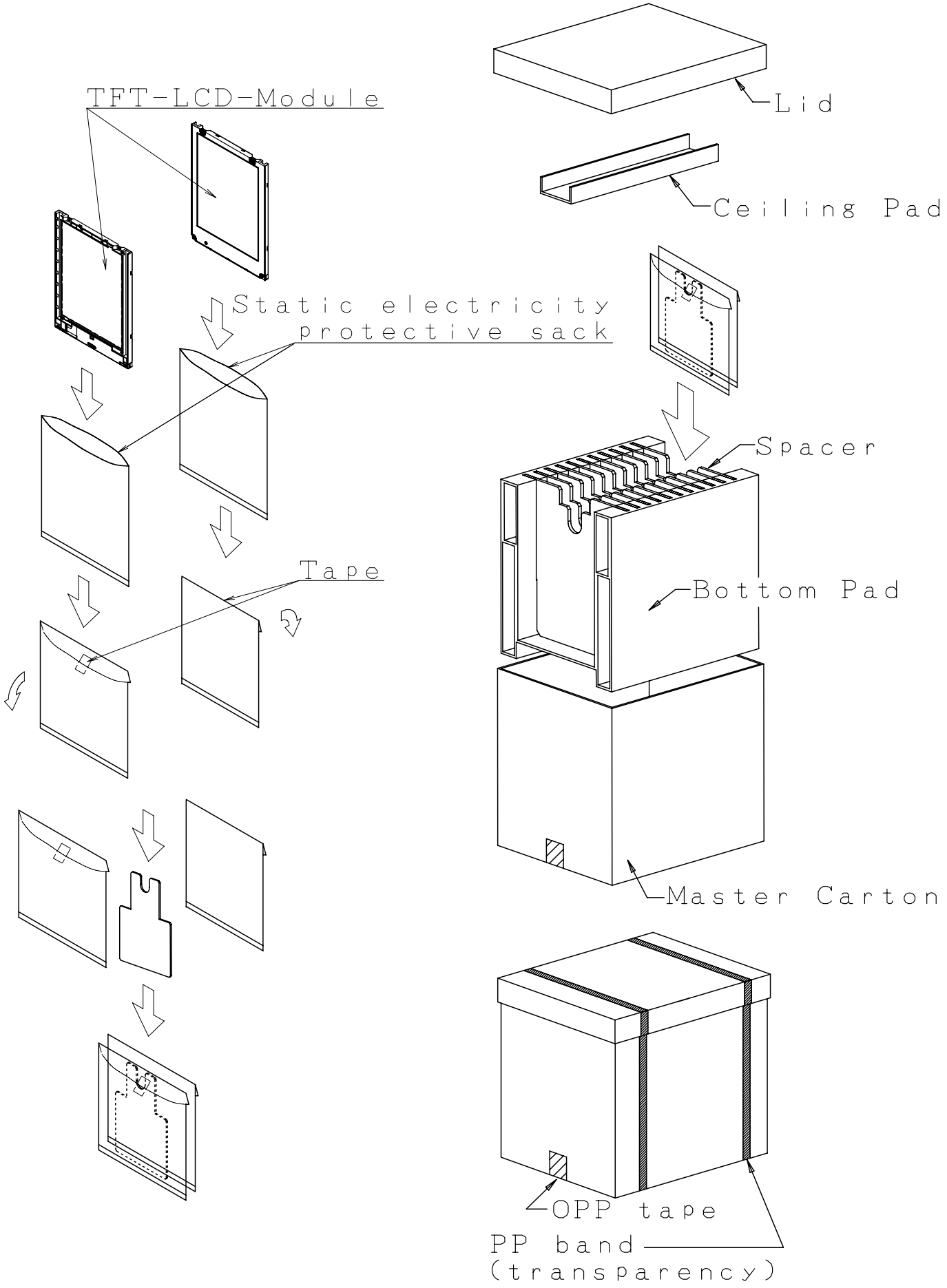
①Model.No ②Shipment Date ③Quntity





※R.C.（RoHS Compliance）means these parts have corresponded with the RoHS directive.

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.



Packing Form

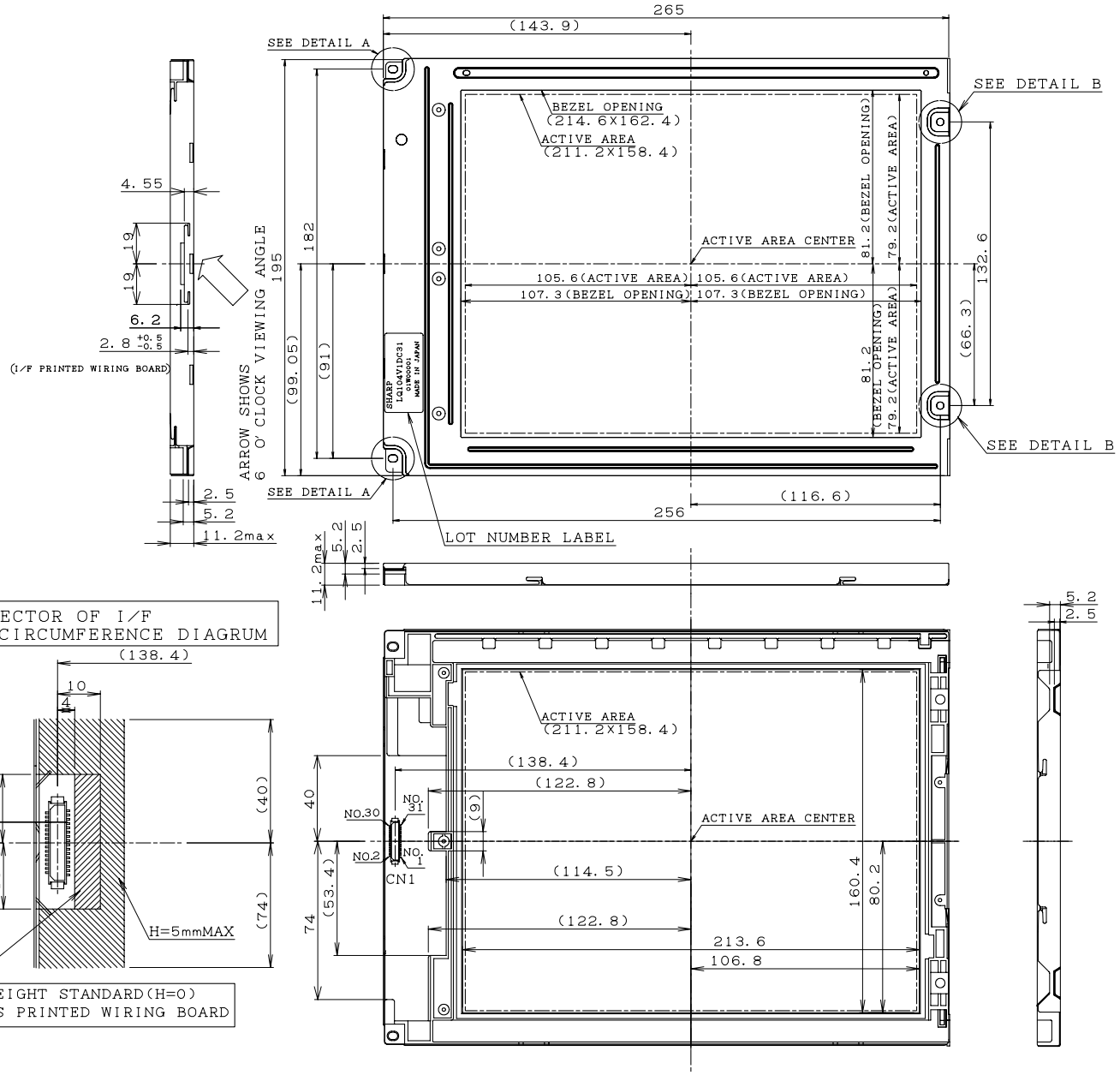


FIG1. LQ104V1DC31 OUTLINE DEMENSIONS

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- Traffic signals
- Alarm equipment
- Gas leakage sensor breakers
- Various safety devices etc.

SHARP's devices shall not be used for equipment that requires extremely high level of reliability, such as:

- Military and space applications
- Nuclear power control equipment
- Medical equipment for life support

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