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Revised :

DEVICE SPECIFICATION FOR

# TFT-LCD Module

MODEL No.

## LQ154K1LA1F

☐ CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

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SHARP CORPORATION

### RECORDS OF REVISION

LQ154K1LA1F

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## 1. Application

This technical literature applies to a color TFT-LCD module, LQ154K1LA1F.

## 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  $1280 \times 3 \times 800$  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.

In this TFT-LCD panel, low reflection / color filters of excellent color performance and backlights of high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

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	39(15.4") Diagonal	cm
Active area	331.2 (H) $\times$ 207.0(V)	mm
Pixel format	1280(H) $\times$ 800(V)	pixel
	(1 pixel = R+G+B dots)	
Aspect ratio	16 : 10	
Pixel pitch	0.259 (H) $\times$ 0.259 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally white	
Surface treatment	Glare and hard-coating 2H	

Parameter		Min.	Typ.	Max.	Unit
Unit outline dimensions [Note 1]	Width	343.5	344.0	344.5	mm
	Height	221.5	222.0	222.5	mm
	Depth	—	—	6.5	mm
Mass		—	590	610	g

[Note 1] excluding backlight cables.

Outline dimensions is shown in Fig.2

#### 4. Input Terminals

##### 4-1. TFT-LCD panel driving

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

Pin No.	Symbol	Function	Remark
1	GND		
2	Vcc	+3.3V power supply	
3	Vcc	+3.3V power supply	
4	Vedid	DDC +3.3V power supply	[Note 4]
5	NC		[Note 3]
6	CLKedid	DDC Clock	[Note 4]
7	DATAedid	DDC Date	[Note 4]
8	RxIN0-	Receiver signal of LVDS CH0 (-)	[Note 1]
9	RxIN0+	Receiver signal of LVDS CH0 (+)	[Note 1]
10	GND		
11	RxIN1-	Receiver signal of LVDS CH1 (-)	[Note 1]
12	RxIN1+	Receiver signal of LVDS CH1 (+)	[Note 1]
13	GND		
14	RxIN2-	Receiver signal of LVDS CH2 (-)	[Note 1]
15	RxIN2+	Receiver signal of LVDS CH2 (+)	[Note 1]
16	GND		
17	CK IN-	Receiver signal of LVDS CLK (-)	[Note 1]
18	CK IN+	Receiver signal of LVDS CLK (+)	[Note 1]
19	GND		
20	NC		[Note 3]
21	NC		[Note 3]
22	GND		
23	NC		[Note 3]
24	NC		[Note 3]
25	GND		
26	NC		[Note 3]
27	NC		[Note 3]
28	GND		
29	NC		[Note 3]
30	NC		[Note 3]

[Note 1] Relation between RxIN<sub>i</sub>(i=0,1,2) and actual data is shown in following section (4-2)(7-2).

[Note 2] The shielding case is connected with signal GND.

[Note 3] Please use NC by OPEN or GND. NC terminal is not connected with the internal circuit.

[Note 4] In case of you don't use EDID, use this pin as OPEN or GND.

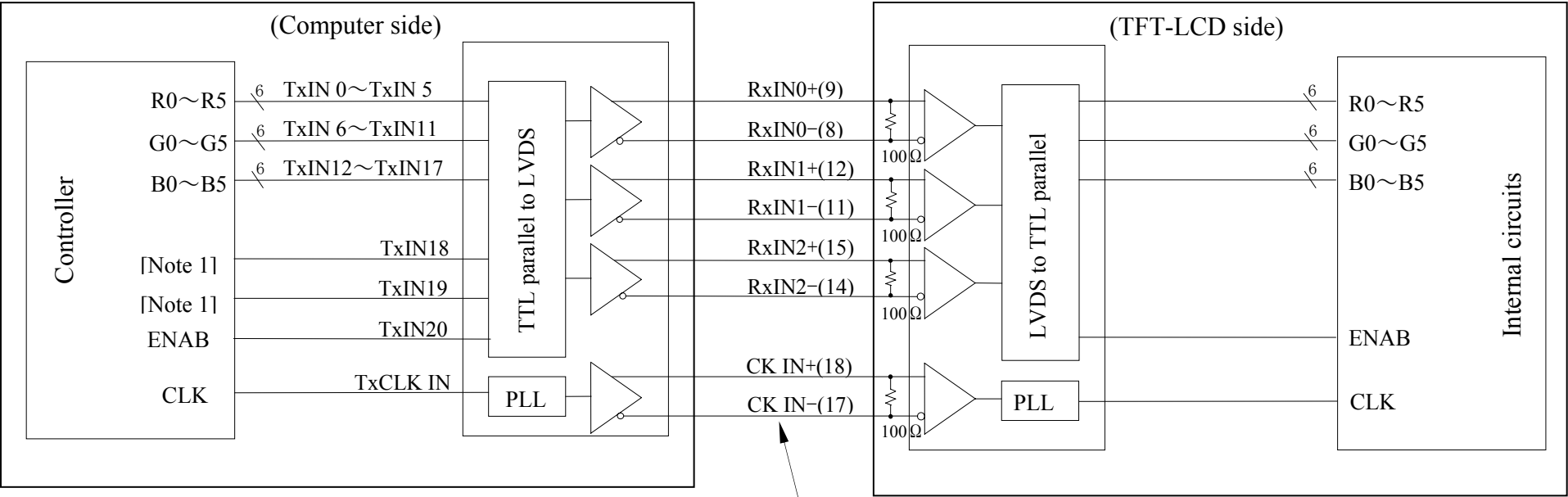
Using connector : FI-XPB30SRL-HF11 (JAE) or equivalent.

Corresponding connector : FI-X30M,FI-X30ML or FI-X30H (JAE)

(Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

4-2. LVDS interface block diagram

Using receiver : Single LVDS interface contained in a control IC  
 Corresponding Transmitter : THC63LVDM63A (THINE) or equivalent



[Note 1] Do not use at high-impedance TxIN 18 - 19.

## 4-3. Backlight driving

CN2 Using connector:BHSR-02VS-1(JST)

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

(Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

Connector No.	Pin No.	Symbol	Function	FL cable color
CN2	1	V <sub>High</sub>	Power supply for lamp (High voltage side)	PINK
	2	V <sub>Low</sub>	Power supply for lamp (Low voltage side)	BLACK

## 5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
Input voltage	V <sub>I</sub>	Ta=25°C	-0.3	V <sub>CC</sub> +0.3	V	[Note 1]
+3.3V supply voltage	V <sub>CC</sub>	Ta=25°C	0	+4.0	V	
Storage temperature	T <sub>stg</sub>	—	-25	+60	°C	[Note 2]
Operating temperature (Ambient)	T <sub>opa</sub>	—	0	+50	°C	

[Note 1] LVDS signals

[Note 2] Humidity : 95%RH Max. at Ta≤+40°C.

Maximum wet-bulb temperature at +39°C or less at Ta&gt;+40°C.

No condensation.

## 6. Electrical Characteristics

## 6-1. TFT-LCD panel driving

Ta=+25°C

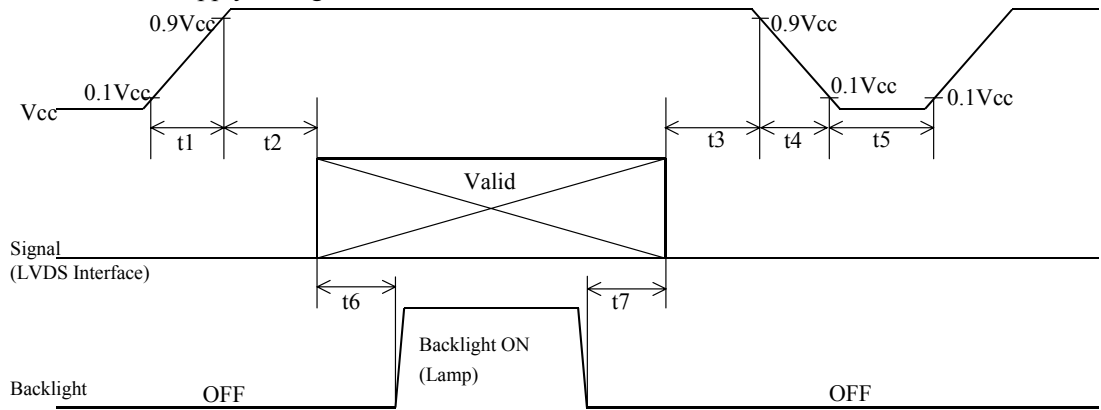
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage		V <sub>CC</sub>	+3.0	+3.3	+3.6	V	[Note 2]
Current dissipation		I <sub>CC</sub>	—	270	400	mA	[Note 3]
Permissive input ripple voltage		V <sub>RP</sub>	—	—	100	mV <sub>P-P</sub>	V <sub>CC</sub> = +3.3V
Input voltage range		V <sub>I</sub>	0		2.4	V	LVDS signals
Differential input threshold voltage	High	V <sub>TH</sub>	—	—	+100	mV	V <sub>CM</sub> = +1.2V [Note 1]
	Low	V <sub>TL</sub>	-100	—	—	mV	
Input current (High)		I <sub>OH</sub>	—	—	±10	μA	V <sub>I</sub> = +2.4V V <sub>CC</sub> = +3.6V
Input current (Low)		I <sub>OL</sub>	—	—	±10	μA	V <sub>I</sub> = 0V V <sub>CC</sub> = 3.6V
Terminal resistor		R <sub>T</sub>	—	100	—	Ω	Differential input

[Note 1] V<sub>CM</sub> : Common mode voltage of LVDS driver.



[Note 2]

On-off conditions for supply voltage



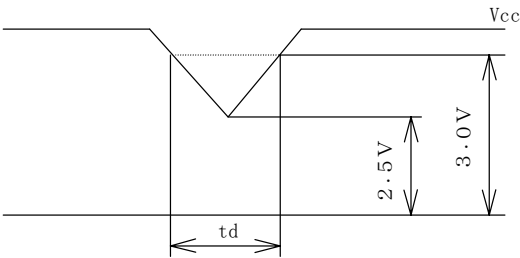
Symbol	Min.	Max.	Unit	Remark
t1	0	10	ms	
t2	0	1	s	
t3	0	1	s	
t4	0	400	ms	
t5	200	—	ms	
t6	180	—	ms	*1
t7	5	—	ms	*1

\*1 : As for the power sequence for backlight, it is recommended to apply above mentioned input timing. If the backlight is lit on and off at a timing other than shown above, displaying image may get disturbed. This is due to variation of output signal from timing generator when LVDS signal is changed from on to off or vice versa, but has no harm to the module itself.

[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

Vcc-dip conditions

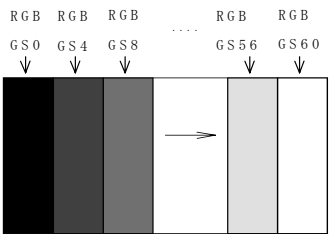
- 1)  $2.5\text{ V} \leq V_{cc} < 3.0\text{ V}$   
 $t_d \leq 10\text{ ms}$   
Under above condition, the display image should return to an appropriate figure after Vcc voltage recovers.
- 2)  $V_{cc} < 2.5\text{ V}$   
Vcc-dip conditions should also follow the On-off conditions for supply voltage



[Note 3] Typical current situation : 16-gray-bar pattern.

Vcc=+3.3V

Maximum current situation : Vcc=+3.0V



## 6-2. Backlight driving

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

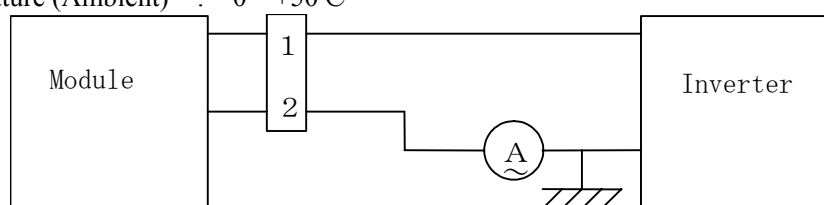
The characteristics of one lamp are shown in the following table.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Lamp current range	$I_L$	3.0	6.0	6.5	mArms	[Note 1]	
Lamp voltage	$V_L$	—	660	—	Vrms		
Lamp power consumption	$P_L$	—	4.0	—	W	[Note 2]	
Lamp frequency	$F_L$	40	60	80	kHz	[Note 3]	
Kick-off voltage	$V_S$	—	—	1100	Vrms	$T_a=0^\circ\text{C}$	[Note 4]
Lamp life time	$L_L$	12000	—	—	Hour	[Note 5]	

[Note 1] The lamp current range, which can be turned on, is shown.

Lamp current measures by connecting the ammeter for high frequency to the  $V_{\text{Low}}$  side in the circuit of the following figure.

- Lamp frequency : 40~80kHz
- Temperature (Ambient) : 0~+50°C



\* 2pin is  $V_{\text{Low}}$

In addition, please check lighting starting nature and lighting stability after mounting a module and an inverter on the occasion of use in a low current region.

[Note 2] Calculated value for reference ( $I_L \times V_L$ )

[Note 3] 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.

[Note 4] 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.

[Note 5] Above value is applicable when lamp is placed horizontally.

Lamp life time is defined that it applied either ① or ② under this condition  
(Continuous turning on at  $T_a=25^\circ\text{C}$ ,  $I_L=6.5\text{mArms}$ )

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

② Kick-off voltage at  $T_a=0^\circ\text{C}$  exceeds maximum value, 1,625Vrms.

(Lamp life time may vary if lamp is in portrait position due to the change of mercury density inside the lamp.)

Lamp life time shortens according to the state of mounting and use.

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

[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.

Be sure to use a back light power supply with the safety protection circuit such as the detection circuit for the excess voltage, excess current and or electric discharge waveform.

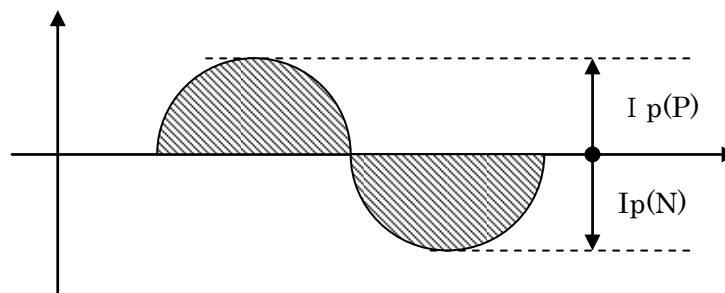
[Note 7] Insulate the high voltage area in order to prevent direct contacts to the area. As countermeasures for excessive heat or exothermic fire, use protection elements such as fuses to cut the circuit.

Use burn-resistant (or noncombustible) material for board or resin.

[Note8] A lamp waveform should satisfy the following conditions.

Crest factor :  $1.20 \leq I_p(P) / I_{rms} \text{ or } I_p(N) / I_{rms} \leq 1.63$

Imbalanced value:  $0.95 \leq I_p(P) / I_p(N) \leq 1.05$



[Note9] Under the environment of 10lx or less, miss-lighting or delay of turn on time may occur.

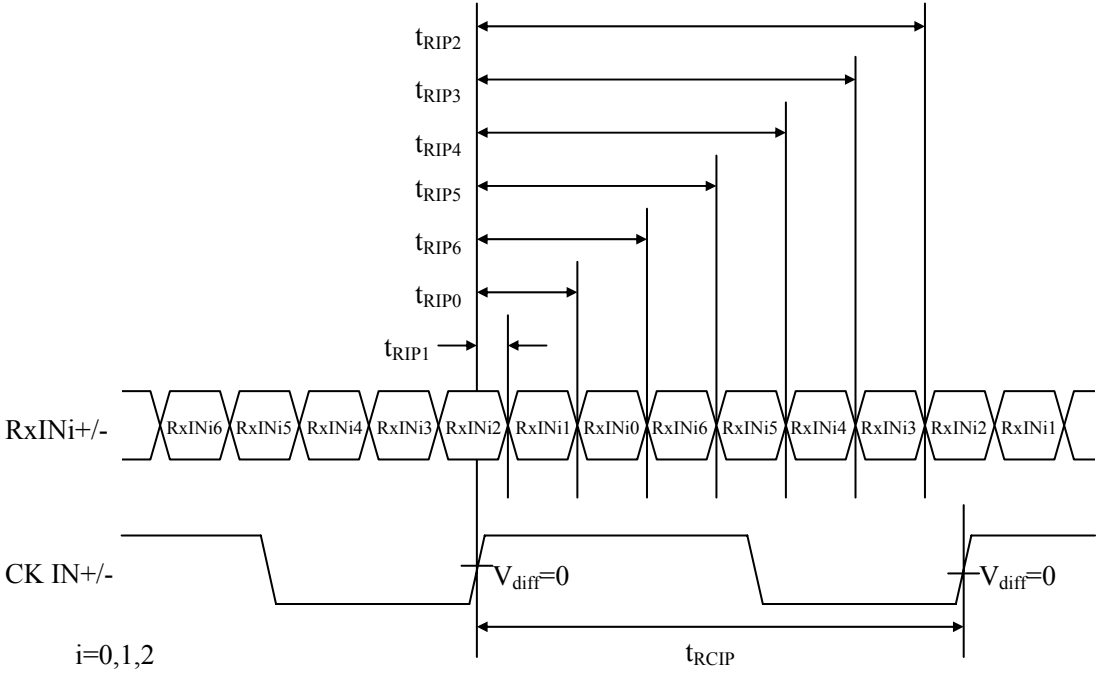
### 6-3. LVDS input specification

#### 6.3.1. AC characteristics

$V_{CC}=+3.0V \sim +3.6V$ ,  $T_a=0^{\circ}C \sim +50^{\circ}C$

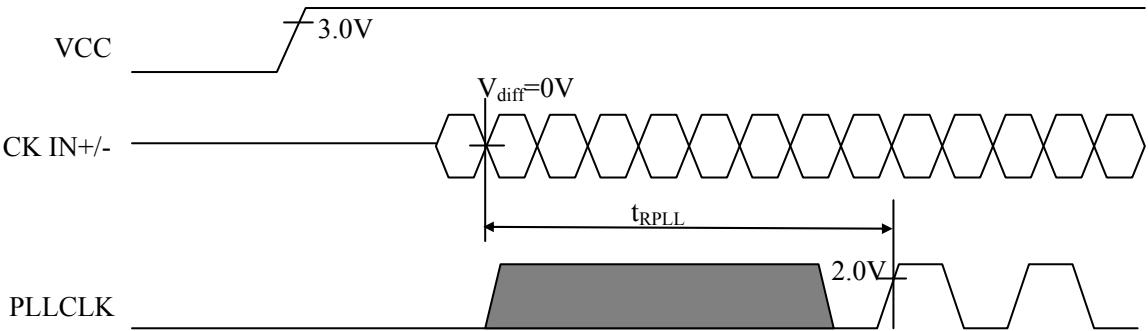
Parameter	Symbol	Min	Typ.	Max.	Unit
Input Data Position 0 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP1</sub>	-0.25	0.0	+0.25	ns
Input Data Position 1 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP0</sub>	t <sub>RCIP</sub> /7-0.25	t <sub>RCIP</sub> /7	t <sub>RCIP</sub> /7+0.25	ns
Input Data Position 2 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP6</sub>	2 t <sub>RCIP</sub> /7-0.25	2 t <sub>RCIP</sub> /7	2 t <sub>RCIP</sub> /7+0.25	ns
Input Data Position 3 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP5</sub>	3 t <sub>RCIP</sub> /7-0.25	3 t <sub>RCIP</sub> /7	3 t <sub>RCIP</sub> /7+0.25	ns
Input Data Position 4 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP4</sub>	4 t <sub>RCIP</sub> /7-0.25	4 t <sub>RCIP</sub> /7	4 t <sub>RCIP</sub> /7+0.25	ns
Input Data Position 5 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP3</sub>	5 t <sub>RCIP</sub> /7-0.25	5 t <sub>RCIP</sub> /7	5 t <sub>RCIP</sub> /7+0.25	ns
Input Data Position 6 (t <sub>RCIP</sub> =15.38ns)	t <sub>RIP2</sub>	6 t <sub>RCIP</sub> /7-0.25	6 t <sub>RCIP</sub> /7	6 t <sub>RCIP</sub> /7+0.25	ns
Phase Lock Loop Set	t <sub>RPLL</sub>	—	—	10	ms
Input Clock Period	t <sub>RCIP</sub>	13.3	14.1	16.6	ns

LVDS input timing

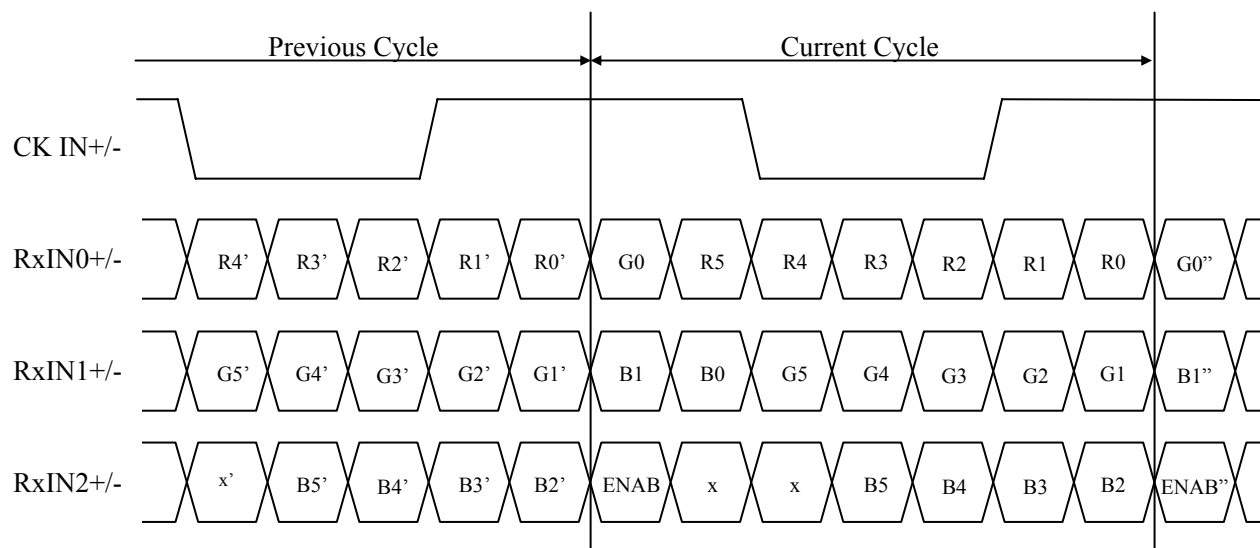


※Note  
 $V_{diff}=(RxINi+)-(RxINi-), (CK IN+)-(CK IN-)$

LVDS phase lock loop set



## 6.3.2. LVDS data



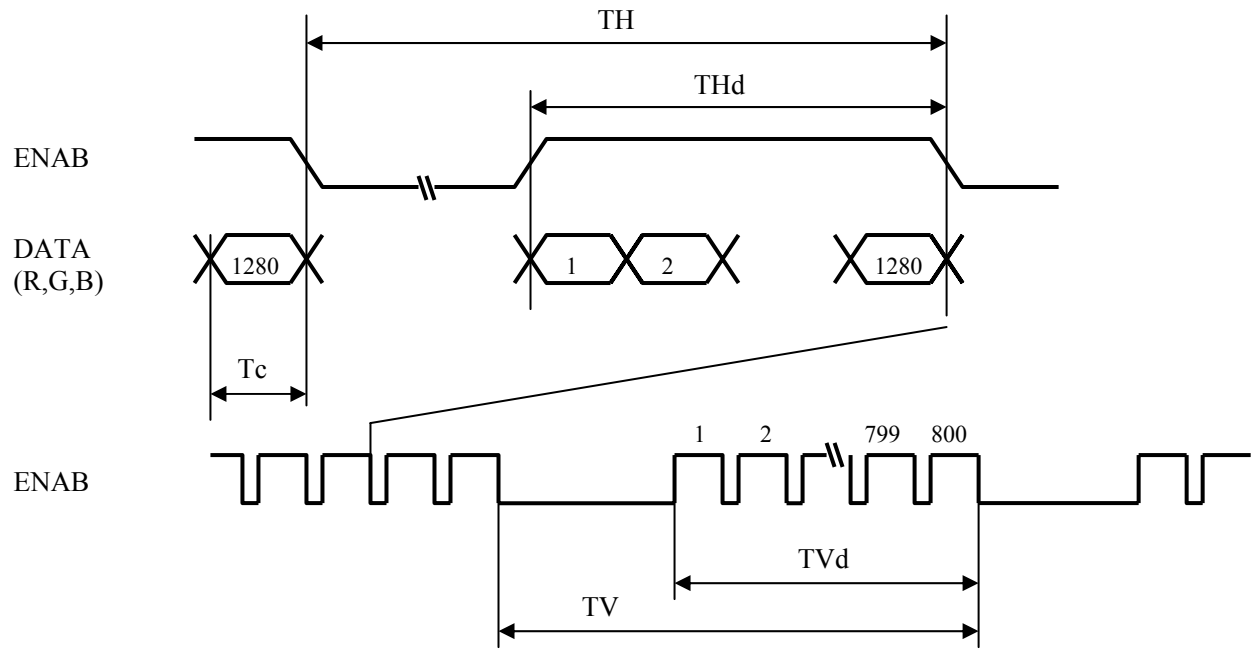
## 7. Timing Characteristics of Input Signals

## 7-1. Timing characteristics

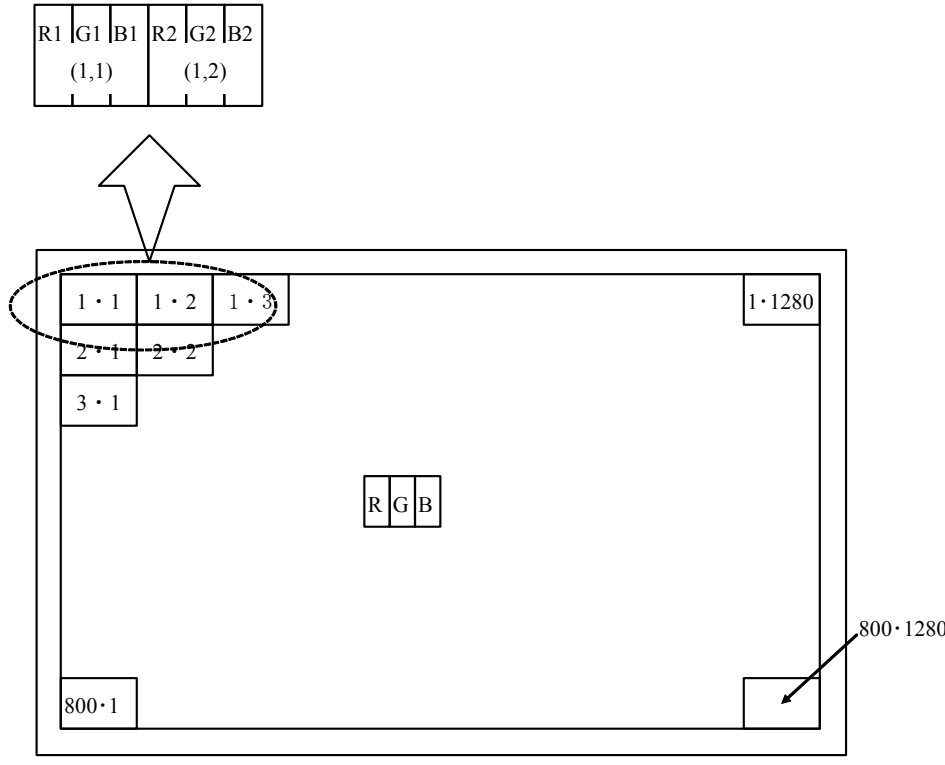
V<sub>CC</sub>=+3.0V~+3.6V, T<sub>a</sub>=0°C~+50°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/T <sub>c</sub>	60	71	75	MHz	[Note 1]
Data enable Signal	Horizontal period	TH	1400	1440	1680	clock	
			19.71	20.28	—	μs	
	Horizontal period (High)	THd	1280	1280	1280	clock	
	Vertical period	TV	803	823	900	Line	
			15.83	16.69	—	ms	
	Vertical period (High)	TVd	800	800	800	line	

[Note 1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.



7-2. Input data signals and display position on the screen



Display position of input data(V · H)

## 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	0	1	1	1	1	1	1	0	0	0	0	0	
	Cyan	—	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	
	Red	—	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	
	Magenta	—	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	
	Yellow	—	1	1	1	1	1	1	1	1	1	1	1	1	1	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	0	1	0	0	0	0	0	0	0	0	0	0	
	Darker	GS2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	↑	↓	↓						↓						↓						
	↓	↓	↓						↓						↓						
	Brighter	GS61	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	
	↓	GS62	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	
	Green	GS63	0	0	0	0	0	0	0	1	1	1	1	1	1	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	0	1	0	1	1	1	1
	↓	GS62	0	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	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. EDID Specifications

※Please use it by EDID specification in the case of use of EDID.

## 9-1. EDID data structure

Byte (decimal)	Byte (hex)	Field Name and Comments	Value (Dec)	Value (hex)	Value (binary)
0	0	Header	0	00	00000000
1	1	Header	255	FF	11111111
2	2	Header	255	FF	11111111
3	3	Header	255	FF	11111111
4	4	Header	255	FF	11111111
5	5	Header	255	FF	11111111
6	6	Header	255	FF	11111111
7	7	Header	0	00	00000000
8	8	EISA manufacture code = SHP	77	4D	01001101
9	9	EISA manufacture code (Compressed ASCII)	16	10	00010000
10	0A	Product code (LQ154K1LA1F : 5101)	237	ED	11101101
11	0B	Product code (hex,LSB first)	19	13	00010011
12	0C	LCD module Serial No (fixed "0")	0	00	00000000
13	0D	LCD module Serial No (fixed "0")	0	00	00000000
14	0E	LCD module Serial No (fixed "0")	0	00	00000000
15	0F	LCD module Serial No (fixed "0")	0	00	00000000
16	10	Week of manufacture (fixed "0")	0	00	00000000
17	11	Year of manufacture - 1990 (ex 2000 - 1990 = 10) (fixed "0")	0	00	00000000
18	12	EDID structure version # = 1	1	01	00000001
19	13	EDID revision # = 3	3	03	00000011
20	14	Video i/p definition = Digital i/p	128	80	10000000
21	15	Max H image size(cm) = 33cm	33	21	00100001
22	16	Max V image size(cm) = 21cm	21	15	00010101
23	17	Display gamma (2.2×100) - 100 = 120	120	78	01111000
24	18	Feature support(stanby,suspend,RGB color/Prefer Time)	202	CA	11001010
25	19	Red/Green Low bit(RxRy/GxGy)	0	00	00000000
26	1A	Blue/White Low bit(BxBy/WxWy)	0	00	00000000
27	1B	Red X(Rx) (written value "0.***")	0	00	00000000
28	1C	Red Y(Ry) (written value "0.***")	0	00	00000000
29	1D	Green X(Gx) (written value "0.***")	0	00	00000000
30	1E	Green Y(Gy) (written value "0.***")	0	00	00000000
31	1F	Blue X(Bx) (written value "0.***")	0	00	00000000
32	20	Blue Y(By) (written value "0.***")	0	00	00000000
33	21	White X(Wx) (written value "0.***")	0	00	00000000

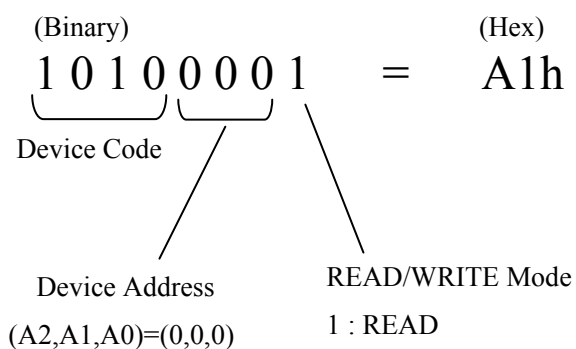


Byte (decimal)	Byte (hex)	Field Name and Comments	Value (Dec)	Value (hex)	Value (binary)
34	22	White Y(Wy) (written value "0.***")	0	00	00000000
35	23	Established timings 1	0	00	00000000
36	24	Established timings 2	0	00	00000000
37	25	Established timings 3	0	00	00000000
38	26	Standard timing ID1	1	01	00000001
39	27	Standard timing ID1	1	01	00000001
40	28	Standard timing ID2	1	01	00000001
41	29	Standard timing ID2	1	01	00000001
42	2A	Standard timing ID3	1	01	00000001
43	2B	Standard timing ID3	1	01	00000001
44	2C	Standard timing ID4	1	01	00000001
45	2D	Standard timing ID4	1	01	00000001
46	2E	Standard timing ID5	1	01	00000001
47	2F	Standard timing ID5	1	01	00000001
48	30	Standard timing ID6	1	01	00000001
49	31	Standard timing ID6	1	01	00000001
50	32	Standard timing ID7	1	01	00000001
51	33	Standard timing ID7	1	01	00000001
52	34	Standard timing ID8	1	01	00000001
53	35	Standard timing ID8	1	01	00000001
54	36	Detailed timing descriptor#1 fck/10000 (=71MHz/10000=7100=1BBCh)	188	BC	10111100
55	37	#1 fck	27	1B	00011011
56	38	#1 Horizontal active 1280=0500h "00h"	0	00	00000000
57	39	#1 Horizontal blanking 160=00A0h "A0h"	160	A0	10100000
58	3A	#1 Horizontal active/Horizontal blanking "50h"	80	50	01010000
59	3B	#1 Vertical active 800=0320h "20h"	32	20	00100000
60	3C	#1 Vertical blanking 23=0017h "17h"	23	17	00010111
61	3D	#1 Vertical active/Vertical blanking "30h"	48	30	00110000
62	3E	#1 Horizontal sync , offset 48=030h "30h"	48	30	00110000
63	3F	#1 Horizontal sync , width 32=020h "20h"	32	20	00100000
64	40	#1 Vertical sync,offset / Vertical sync,width (offset=3h/width=6h)	54	36	00110110
65	41	#1 Horizontal sync offset/width/Vertical sync offset/width	0	00	00000000
66	42	#1 Horizontal image size 331mm=014Bh "4Bh"	75	4B	01001011
67	43	#1 Vertical image size 207mm=00CFh "CFh"	207	CF	11001111
68	44	#1 Horizontal image size / Vertical image size "10h"	16	10	00010000
69	45	Horizontal boader	0	00	00000000

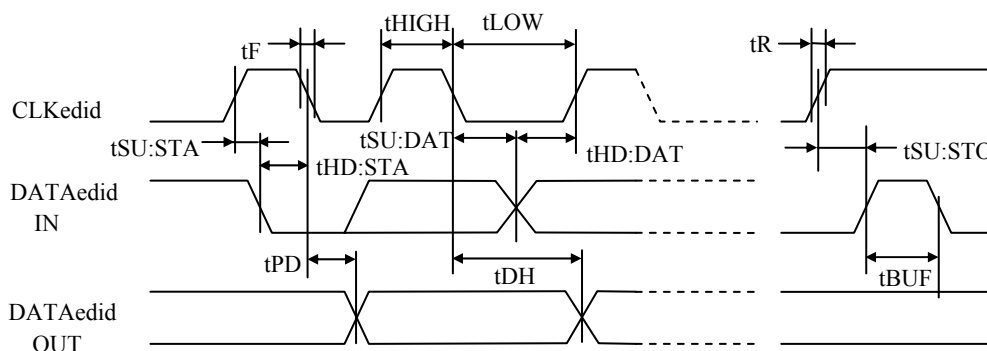
Byte (decimal)	Byte (hex)	Field Name and Comments	Value (Dec)	Value (hex)	Value (binary)
70	46	Vertical boader	0	00	00000000
71	47	Flags(Non-interlaced/Horizontal polarity/Vertical polarity)	25	19	00011001
72	48	Detailed timing descriptor #2	0	00	00000000
73	49	Flag	0	00	00000000
74	4A	Reserved	0	00	00000000
75	4B	Dummy Descriptor	16	10	00010000
76	4C	Flag	0	00	00000000
77	4D	1st dummy	0	00	00000000
78	4E	2nd dummy	0	00	00000000
79	4F	3rd dummy	0	00	00000000
80	50	4th dummy	0	00	00000000
81	51	5th dummy	0	00	00000000
82	52	6th dummy	0	00	00000000
83	53	7th dummy	0	00	00000000
84	54	8th dummy	0	00	00000000
85	55	9th dummy	0	00	00000000
86	56	10th dummy	0	00	00000000
87	57	11th dummy	0	00	00000000
88	58	New line character #2 indicates end	10	0A	00001010
89	59	Padding with “blank” character	32	20	00100000
90	5A	Detailed timing descriptor #3	0	00	00000000
91	5B	Flag	0	00	00000000
92	5C	Reserved	0	00	00000000
93	5D	Dummy Descriptor	16	10	00010000
94	5E	Flag	0	00	00000000
95	5F	1st Dummy	0	00	00000000
96	60	2nd Dummy	0	00	00000000
97	61	3rd Dummy	0	00	00000000
98	62	4th Dummy	0	00	00000000
99	63	5th Dummy	0	00	00000000
100	64	6th Dummy	0	00	00000000
101	65	7th Dummy	0	00	00000000
102	66	8th Dummy	0	00	00000000
103	67	9th Dummy	0	00	00000000
104	68	10th Dummy	0	00	00000000
105	69	11th Dummy	0	00	00000000

Byte (decimal)	Byte (hex)	Field Name and Comments	Value (Dec)	Value (hex)	Value (binary)
106	6A	New line character #3 indicates end	10	0A	00001010
107	6B	Padding with “blank” character	32	20	00100000
108	6C	Detailed timing descriptor #4	0	00	00000000
109	6D	Flag	0	00	00000000
110	6E	Reserved	0	00	00000000
111	6F	Dummy descriptor	16	10	00010000
112	70	Flag	0	00	00000000
113	71	Supplier P/N#1 (L)	76	4C	01001100
114	72	Supplier P/N#2 (Q)	81	51	01010001
115	73	Supplier P/N#3 (1)	49	31	00110001
116	74	Supplier P/N#4 (5)	53	35	00110101
117	75	Supplier P/N#5 (4)	52	34	00110100
118	76	Supplier P/N#6 (K)	75	4B	01001011
119	77	Supplier P/N#7 (1)	49	31	00110001
120	78	Supplier P/N#8 (L)	76	4C	01001100
121	79	Supplier P/N#9 (A)	65	41	01000001
122	7A	Supplier P/N#10 (1)	49	31	00110001
123	7B	Supplier P/N#11 (F)	70	46	01000110
124	7C	Supplier P/N#12 ("Space")	32	20	00100000
125	7D	(If<13 char,then terminate with ASCII code 0Ah,set remaining char 20h)	10	0A	00001010
126	7E	Extension flag	0	00	00000000
127	7F	Checksum	65	41	01000001

## 9-2. Device addressing (slave address)



## 9-3. EDID timing characteristics



## Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit.	Remark
			Min.	Max.		
Input voltage	V <sub>I</sub>	T <sub>a</sub> =25°C	-0.3	V <sub>CC</sub> +0.3	V	【Note】
Supply voltage	V <sub>edid</sub>	T <sub>a</sub> =25°C	0	+6.5	V	

【Note】 It applies to DATA<sub>edid</sub>・CLK<sub>edid</sub>

## Recommended Operating Voltage

Parameter	Symbol	Condition	Ratings		Unit.	Remark
			Min.	Max.		
Input voltage	V <sub>I</sub>	T <sub>a</sub> =25°C	0	V <sub>CC</sub>	V	【Note】
Supply voltage	V <sub>edid</sub>	T <sub>a</sub> =25°C	2.7	+5.5	V	

【Note】 It applies to DATA<sub>edid</sub>・CLK<sub>edid</sub>

## DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
"H" input voltage	V <sub>IH</sub>	0.7V <sub>edid</sub>	—	—	V	
"L" input voltage	V <sub>IL</sub>	—	—	0.3V <sub>edid</sub>	V	
"L" output voltage	V <sub>OL</sub>	—	—	0.4	V	I <sub>OL</sub> =3.0mA
Input leak current	I <sub>LI</sub>	-1.0	—	1.0	μA	
Output leak current	I <sub>LO</sub>	-1.0	—	1.0	μA	
Current dissipation (operating)	I <sub>CC</sub>	—	—	2.0	mA	V <sub>edid</sub> =5.5V, DATA <sub>edid</sub> , CLK <sub>edid</sub> =V <sub>edid</sub>

## AC Characteristics

Parameter	Symbol	High-speed operation mode 4.5V ≤ V <sub>edid</sub> ≤ 5.5V			Standard operation mode 2.7V ≤ V <sub>edid</sub> ≤ 5.5V			Unit.	Remark
		Min.	Typ.	Max.	Min.	Typ.	Max.		
CLK <sub>edid</sub> frequency	f <sub>SCL</sub>	—	—	400	—	—	100	kH z	
CLK <sub>edid</sub> "H" time	t <sub>HIGH</sub>	0.6	—	—	4.0	—	—	μs	
CLK <sub>edid</sub> "L" time	t <sub>LOW</sub>	1.2	—	—	4.7	—	—	μs	
DATA <sub>edid</sub> ・CLK <sub>edid</sub> rising time	t <sub>R</sub>	—	—	0.3	—	—	1.0	μs	
DATA <sub>edid</sub> ・CLK <sub>edid</sub> falling time	t <sub>F</sub>	—	—	0.3	—	—	0.3	μs	
Start condition hold time	t <sub>HD:STA</sub>	0.6	—	—	4.0	—	—	μs	
Start condition setup time	t <sub>SU:STA</sub>	0.6	—	—	4.7	—	—	μs	
Input data hold time	t <sub>HD:DAT</sub>	0	—	—	0	—	—	ns	
Input data setup time	t <sub>SU:DAT</sub>	100	—	—	250	—	—	ns	
Output data delay time	t <sub>PD</sub>	0.1	—	0.9	0.2	—	3.5	μs	
Output data hold time	t <sub>DH</sub>	0.1	—	—	0.2	—	—	μs	
Stop condition setup time	t <sub>SU:STO</sub>	0.6	—	—	4.7	—	—	μs	
Bus release time	t <sub>BUF</sub>	1.2	—	—	4.7	—	—	μs	
Noise removal valid time	t <sub>I</sub>	—	—	0.1	—	—	0.1	μs	【Note】

【Note】 It applies to DATA<sub>edid</sub>・CLK<sub>edid</sub>

## 10. Optical Characteristics

Ta=+25°C, Vcc=+3.3V

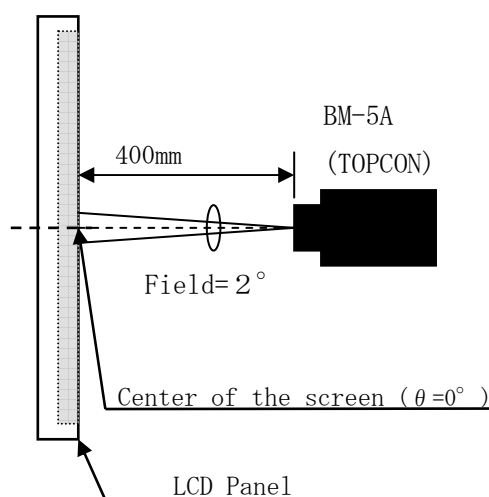
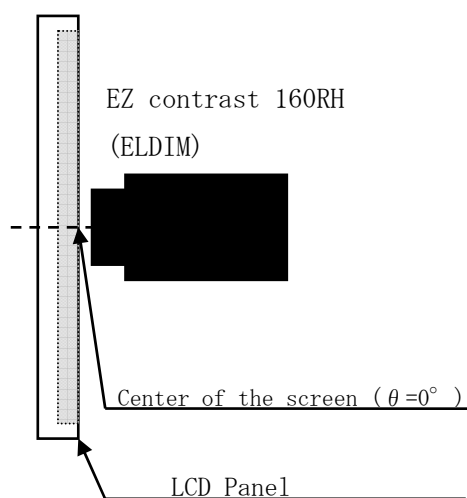
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing angle range	Horizontal	$\theta_{21}, \theta_{22}$	CR>10	60	70	—	Deg.	[Note 1,3,6]	
	Vertical	$\theta_{11}$		40	50	—	Deg.		
		$\theta_{12}$		50	60	—	Deg.		
Contrast ratio		CRn	$\theta = 0^\circ$	300	—	—		[Note 2,4,6]	
		CRo	Optimum viewing angle	300	450	—			
Response time		$\tau_r + \tau_d$	$\theta = 0^\circ$	—	15	20	ms	[Note 2,5,6]	
Chromaticity of white		x		0.283	0.313	0.343		[Note 2,6]	
		y		0.299	0.329	0.359			
Luminance of white		$Y_{Li}$		230	290	—	cd/m <sup>2</sup>	[Note 2,6]	$I_L=6.0\text{mA}_{rms}$ $F_L=60\text{kHz}$
White Uniformity		$\delta_w$		—	1.20	1.45		[Note 2,7]	

The measurement shall be executed 30 minutes after lighting at rating. Condition : ( $I_L=6.0\text{mA rms}$ )

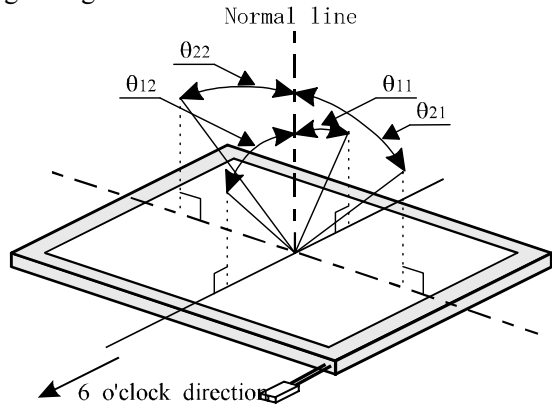
The optical characteristics shall be measured in a dark room or equivalent.

[Note 1] Measuring Viewing Angle Range

[Note 2] Other Measurements



[Note 3] Definitions of viewing angle range:



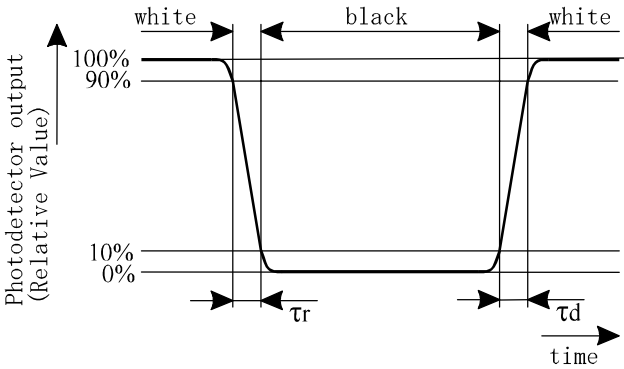
[Note 4] Definition of contrast ratio:

The contrast ratio is defined as the following.

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

[Note 5] 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" .

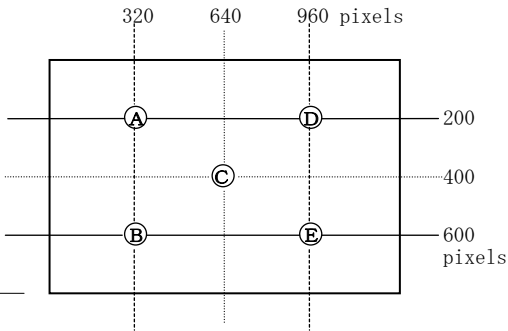


[Note 6] This shall be measured at center of the screen.

[Note 7] Definition of white uniformity:

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

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



## 11. Display Quality

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

## 12. 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.  
Blow away dust on the polarizer with antistatic N<sub>2</sub> blow. It is undesirable to wipe off because a polarizer is sensitive. It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer.  
When unavoidable, wipe off carefully with a cloth for wiping lenses.
- 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 requirements in handling components.
- h) Since there is a circuit board in the module back, stress is not added at the time of a design assembly.  
Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.
- i) 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.  
Blow off 'dust' on the polarizer by using an ionized nitrogen.
- j) 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.
- k) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.
- l) Connect GND of mounting holes to stabilize against EMI and external noise.
- m) When handling LCD modules and assembling them into cabinets, please avoid that long-terms 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 modules.
- n) Cold cathode fluorescent lamp in LCD panel contains a small amount of mercury, please follow local ordinances or regulations for disposal.
- o) Be careful of a back light lead not to pull by force at the time of the wiring to an inverter, or line processing.
- p) When install LCD modules in the cabinet, please tighten with “torque = 0.196 N·m(Max).  
Be sure to confirm it in the same condition as it is installed in your instrument.
- q) 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.
- r) Notice : Never dismantle the module , because it will cause failure.  
Please don't remove the fixed tape, insulating tape etc that was pasted on the original module.  
(Except for protection film of the panel and the crepe tape (yellow tape) of fixing lamp cable temporarily.)
- s) Be careful when using it for long time with fixed pattern display as it may cause afterimage.  
(Please use a screen saver etc., in order to avoid an afterimage.)
- t) Adjusting volume has been set optimally before shipment, so do not change any adjusted value.  
If adjusted value is changed, the specification may not be satisfied.
- u) The lamp used for this product is very sensitive to the temperature.  
Luminance decreases rapidly when it is used for a long time or repeatedly under the environment of the low temperature or the module is being cooled.

Please avoid the continuous or repeating use of it under such an environment.

## 13. Packing form

Piling number of cartons	Max.6
Package quantity in one carton	10 pcs
Carton size	415 (W)×311(D)×295(H) mm
Total mass of one carton filled with full modules	7.9kg
Packing form	Fig.1

## 14. Reliability Test Items

No.	Test item	Conditions
1	High temperature operation test	Ta = +50°C 240h (Panel-surface temperature is +60°C Max.)
2	Low temperature operation test	Ta = 0°C 240h
3	High temperature storage test	Ta = +60°C 240h
4	Low temperature storage test	Ta = -25°C 240h
5	High temperature & high humidity operation test	Ta = +40°C ; 95 %RH 240h (No condensation)
6	Shock test (non- operating)	Max. gravity : 490 m/s <sup>2</sup> Pulse width : 11 ms, half sine wave Direction : $\pm X, \pm Y, \pm Z$ once for each direction.
7	Vibration test (non- operating)	Frequency : 10~57Hz: half amplitude 0.076mm 57~500Hz: Gravity 9.8m/s <sup>2</sup> Sweep time: 11minutes Test time: 3h (X,Y,Z 1h for each direction)

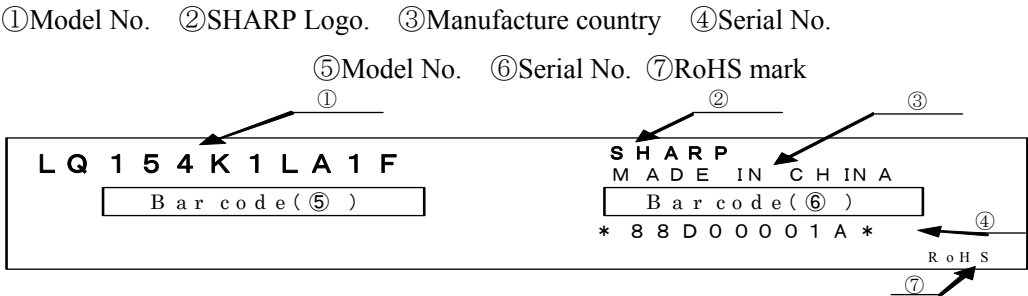
## [Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function. (normal operation state : Temperature:15~35°C, Humidity:45~75%, Atmospheric pressure:86~106kpa)

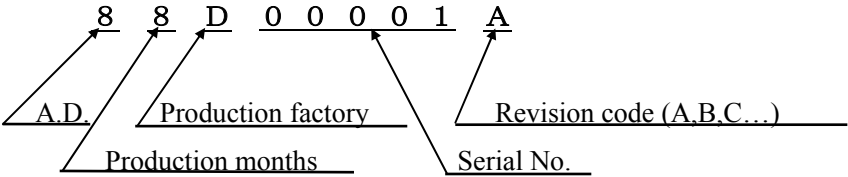


15. Label

1) Module Bar code label:



Serial No.

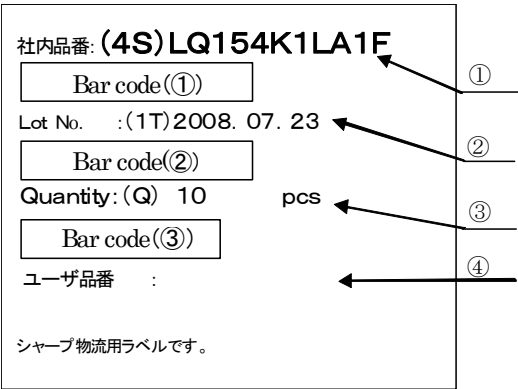


(Production months)

1-9(Jan.-Sep.),X(Oct.),Y(Nov.),Z(Dec)

2) Packing bar code label

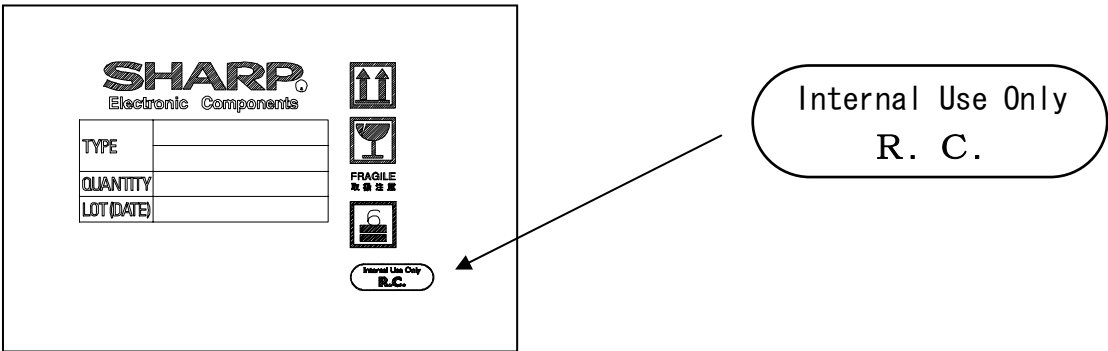
Notation/ Bar code: ①Model No.    ②Date    ③Quantity    ④User Part No.



16. RoHS Regulations

This LCD module is compliant with RoHS Directive.

Carton mark



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

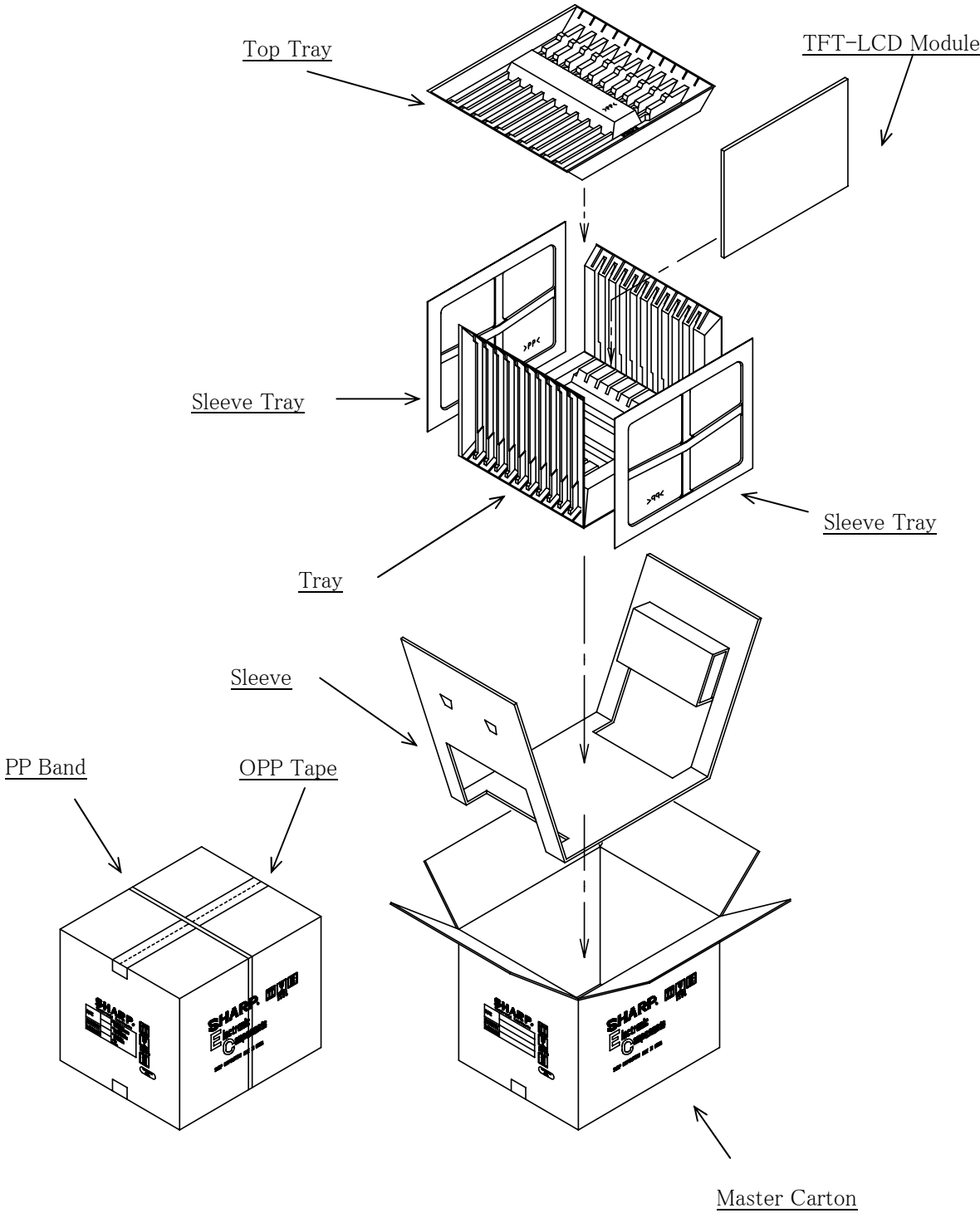


Fig.1 Packing Form

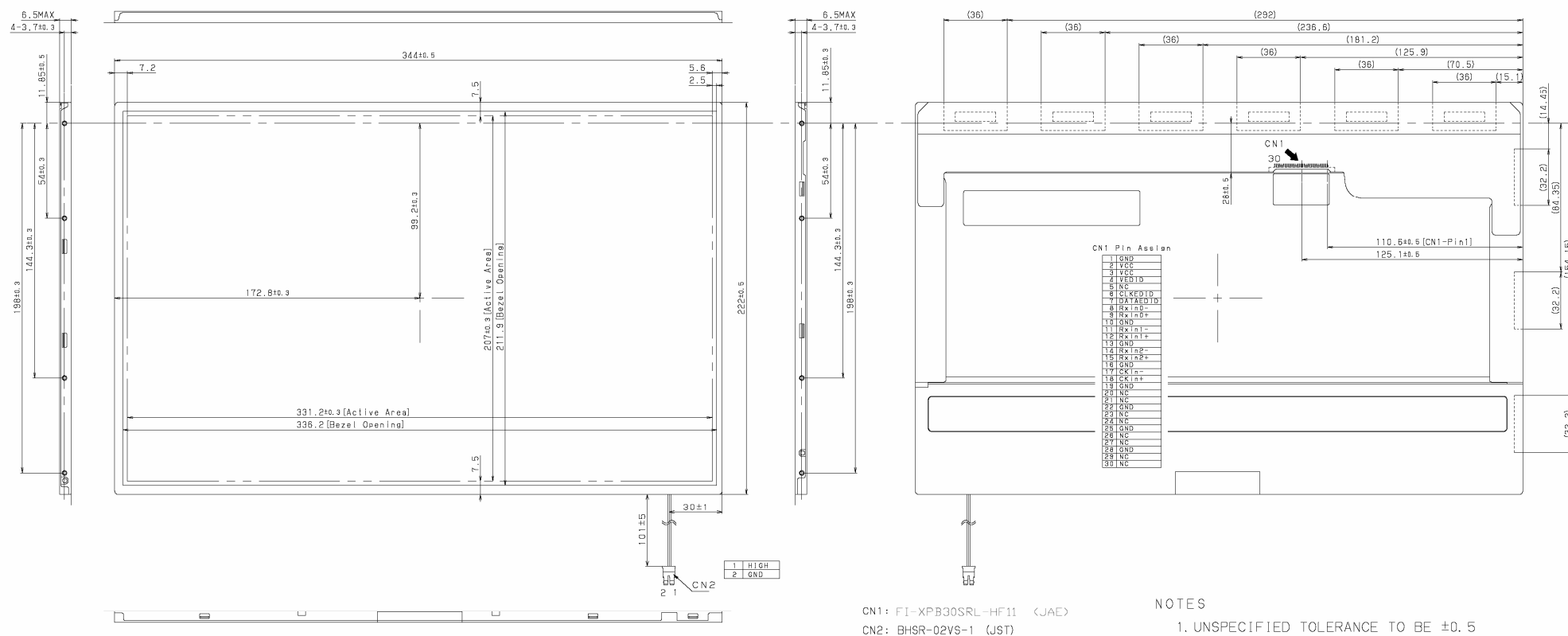


Fig.2 Outline Dimensions