1. Application

This specification applies to the color 64.5" TFT-LCD module LK645D3LZ9S.

* These specification sheets are proprietary products of SHARP CORPORATION ("SHARP") and include materials protected under copyright of SHARP. Do not reproduce or cause any third party to reproduce them in any form or by any means, electronic or mechanical, for any purpose, in whole or in part, without the express written permission of SHARP.

* 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 that 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, power supply circuit, inverter circuit and back light system etc. Graphics and texts can be displayed on a 1920×RGB×1080 dots panel with about 1073 million colors by using LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

This module also includes the DC/AC inverter to drive the CCFTs. (+60V/+12 of DC supply voltage)

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit .In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With this technology, image signals can be set so that liquid crystal response completes within one frame. As a result, motion blur reduces and clearer display performance can be realized.

This LCD module also adopts Double Frame Rate driving method. With combination of these technologies, motion blur can be reduced and clearer display performance can be realized.

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	163.9 (Diagonal)	cm
	64.5 (Diagonal)	inch
Active area	1428.48(H) x 803.52 (V)	mm
Pixel Format	1920(H) x 1080(V) (1pixel = R + G + B dot)	pixel
Pixel pitch	0.744(H) x 0.744 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit Outline Dimensions (*1)	1498(W) x 874.4 (H) x60.8 (D)	mm
Mass	32.5+/- 1.0	kg
Surface treatment	Anti glare, low reflection coating Hard coating: 2H	

(*1) Outline dimensions are shown in Fig.1-1,1-2.

4. Input Terminals

4-1. TFT panel driving

CN1 (Interface signals and +12V DC power supply) (Shown in Fig.1-2)

Using connector : FI-RE51S-HF (Japan Aviation Electronics Ind. , Ltd.)

Mating connector : FI-RE51HL, FI-RE51CL (Japan Aviation Electronics Ind. , Ltd.)

Mating LVDS transmitter :THC63LVD1023(THine) or equivalent device

Pin No.	Symbol	Function	Remark
1	GND		
2	TEMP1	Data1 of panel surface temperature [Note3]	Internally Pull up(by 10kΩ)
3	TEMP2	Data2 of panel surface temperature [Note3]	Internally Pull up(by 10kΩ)
4	TEMP3	Data3 of panel surface temperature [Note3]	Internally Pull up(by 10kΩ)
5	FRAME	Frame frequency setting H : 120Hz ,L : 100Hz	Internally Pull down(by 10kΩ)
6	O/S_set	O/S operating setting [Note3]	Internally Pull up(by 10kΩ)
7	SELLVDS	Select LVDS data order [Note1]	Internally Pull up(by 10kΩ)
8	Reserved		Don't use(must be open)
9	R/L	Horizontal shift direction [Note2]	Internally Pull down(by 10kΩ)
10	Reserved		Don't use(must be open)
11	GND		
12	AIN0-	Aport (-)LVDS CH0 differential data input	
13	AIN0+	Aport (+)LVDS CH0 differential data input	
14	AIN1-	Aport (-)LVDS CH1 differential data input	
15	AIN1+	Aport (+)LVDS CH1 differential data input	
16	AIN2-	Aport (-)LVDS CH2 differential data input	
17	AIN2+	Aport (+)LVDS CH2 differential data input	
18	GND		
19	ACK-	Aport LVDS Clock signal(-)	
20	ACK+	Aport LVDS Clock signal(+)	
21	GND		
22	AIN3-	Aport (-)LVDS CH3 differential data input	
23	AIN3+	Aport (+)LVDS CH3 differential data input	
24	AIN4-	Aport (-)LVDS CH4 differential data input	
25	AIN4+	Aport (+)LVDS CH4 differential data input	
26	GND		
27	GND		
28	BIN0-	Bport (-)LVDS CH0 differential data input	
29	BIN0+	Bport (+)LVDS CH0 differential data input	
30	BIN1-	Bport (-)LVDS CH1 differential data input	
31	BIN1+	Bport (+)LVDS CH1 differential data input	
32	BIN2-	Bport (-)LVDS CH2 differential data input	
33	BIN2+	Bport (+)LVDS CH2 differential data input	
34	GND		
35	BCK-	Bport LVDS Clock signal(-)	
36	BCK+	Bport LVDS Clock signal(+)	
37	GND		
38	BIN3-	Bport (-)LVDS CH3 differential data input	
39	BIN3+	Bport (+)LVDS CH3 differential data input	
40	BIN4-	Bport (-)LVDS CH4 differential data input	
41	BIN4+	Bport (+)LVDS CH4 differential data input	
42	GND	GND	
43	GND	GND	
44	GND	GND	
45	GND	GND	

46	GND	GND	
47	Reserved		Don't use(must be open)
48	VCC	+12V Power Supply	
49	VCC	+12V Power Supply	
50	VCC	+12V Power Supply	
51	VCC	+12V Power Supply	

CN2 (Interface signals) (Shown in Fig1-2)

Using connector : FI-RE41S-HF (Japan Aviation Electronics Ind., Ltd.)

Mating connector : FI-RE41HL, FI-RE41CL (Japan Aviation Electronics Ind., Ltd.)

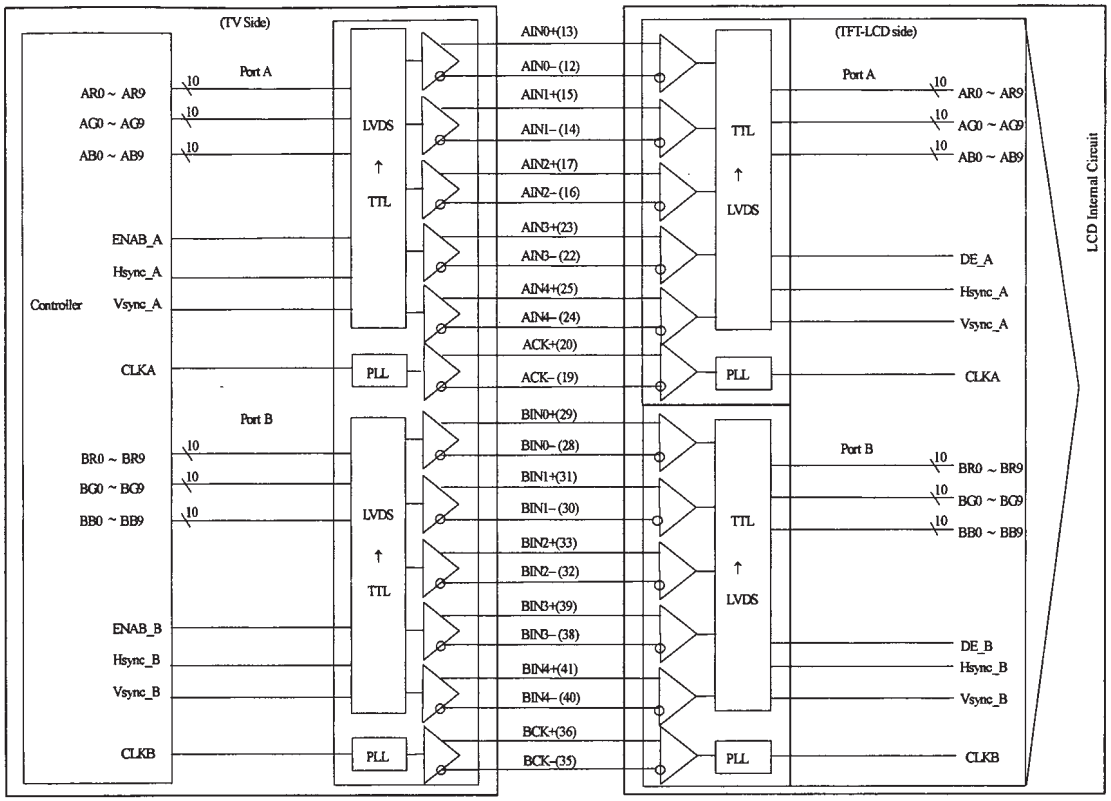
Pin No.	Symbol	Function	Remark
1	Reserved (VCC)	(+12V Power Supply)	
2	Reserved (VCC)	(+12V Power Supply)	
3	Reserved (VCC)	(+12V Power Supply)	
4	Reserved (VCC)	(+12V Power Supply)	
5	Reserved		Don't use(must be open)
6	Reserved		Don't use(must be open)
7	Reserved		
8	Reserved		
9	GND		
10	CIN0-	Cport (-)LVDS CH0 differential data input	
11	CIN0+	Cport (+)LVDS CH0 differential data input	
12	CIN1-	Cport (-)LVDS CH1 differential data input	
13	CIN1+	Cport (+)LVDS CH1 differential data input	
14	CIN2-	Cport (-)LVDS CH2 differential data input	
15	CIN2+	Cport (+)LVDS CH2 differential data input	
16	GND		
17	CCK-	Cport LVDS Clock signal(-)	
18	CCK+	Cport LVDS Clock signal(+)	
19	GND		
20	CIN3-	Cport (-)LVDS CH3 differential data input	
21	CIN3+	Cport (+)LVDS CH3 differential data input	
22	CIN4-	Cport (-)LVDS CH4 differential data input	
23	CIN4+	Cport (+)LVDS CH4 differential data input	
24	GND		
25	GND		
26	DIN0-	Dport (-)LVDS CH0 differential data input	
27	DIN0+	Dport (+)LVDS CH0 differential data input	
28	DIN1-	Dport (-)LVDS CH1 differential data input	
29	DIN1+	Dport (+)LVDS CH1 differential data input	
30	DIN2-	Dport (-)LVDS CH2 differential data input	
31	DIN2+	Dport (+)LVDS CH2 differential data input	
32	GND		
33	DCK-	Dport LVDS Clock signal(-)	
34	DCK+	Dport LVDS Clock signal(+)	
35	GND		
36	DIN3-	Dport (-)LVDS CH3 differential data input	
37	DIN3+	Dport (+)LVDS CH3 differential data input	
38	DIN4-	Dport (-)LVDS CH4 differential data input	
39	DIN4+	Dport (+)LVDS CH4 differential data input	
40	GND		
41	GND		

[note] GND of a liquid crystal panel drive part has connected with a module chassis.

[note] L,"0": Low level voltage (GND) H,"1": High level voltage(3.3V)

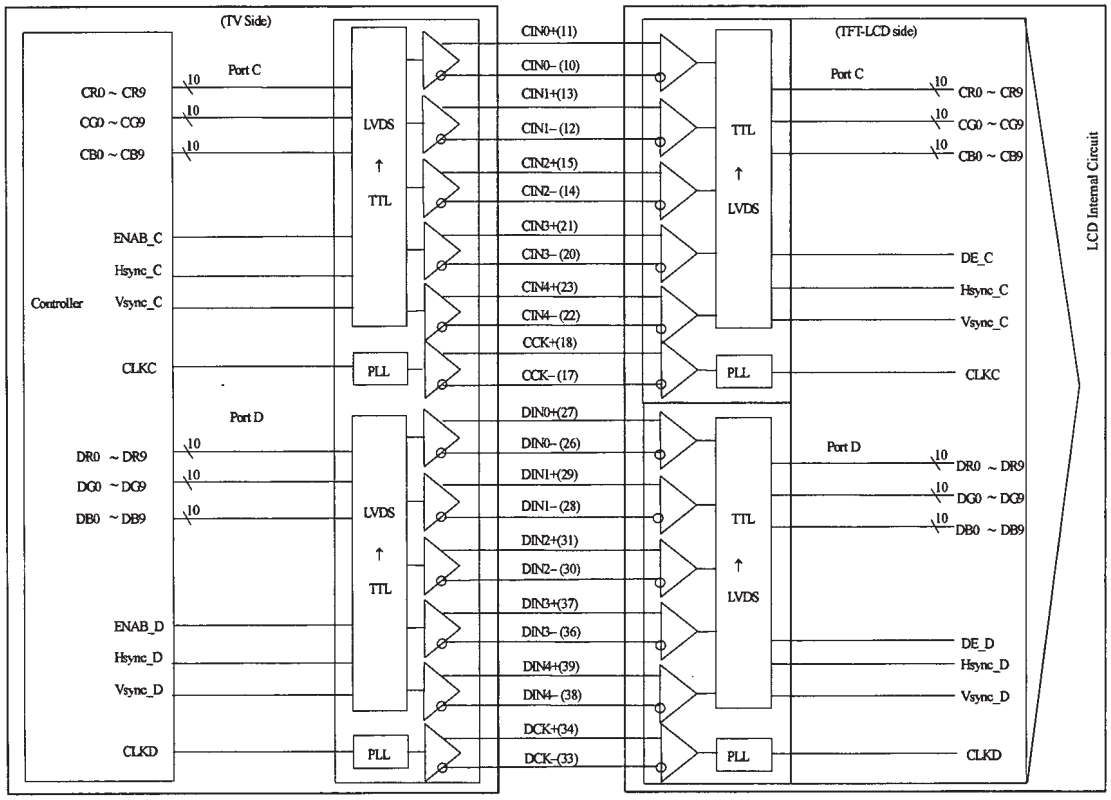
Interface block diagram

CN1 side:



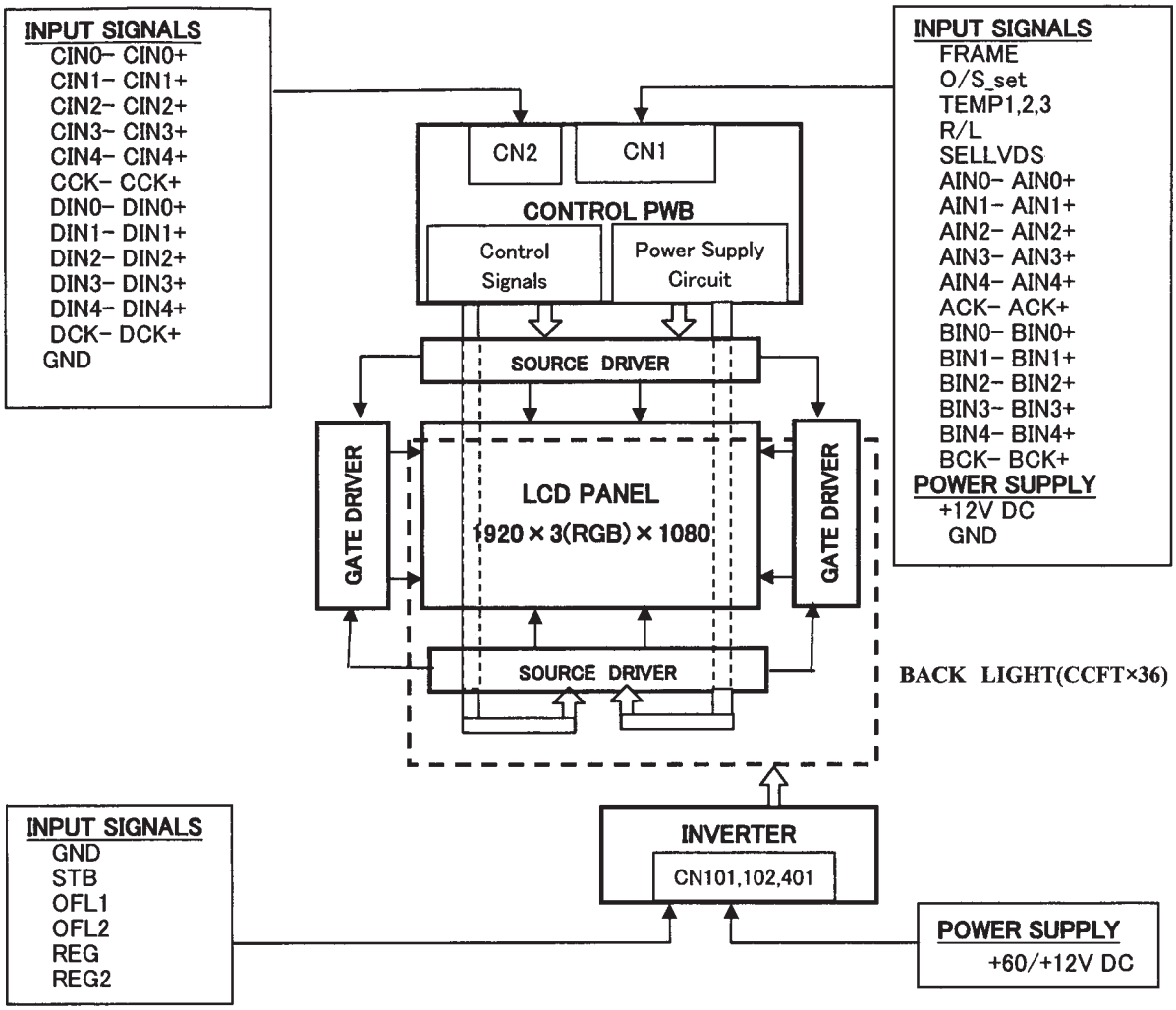
Corresponding Transmitter: THC63LVD1023 (THine) or equivalent device.

CN2 side:



Corresponding Transmitter: THC63LVD1023 (THine) or equivalent device.

Block Diagram (LCD Module)

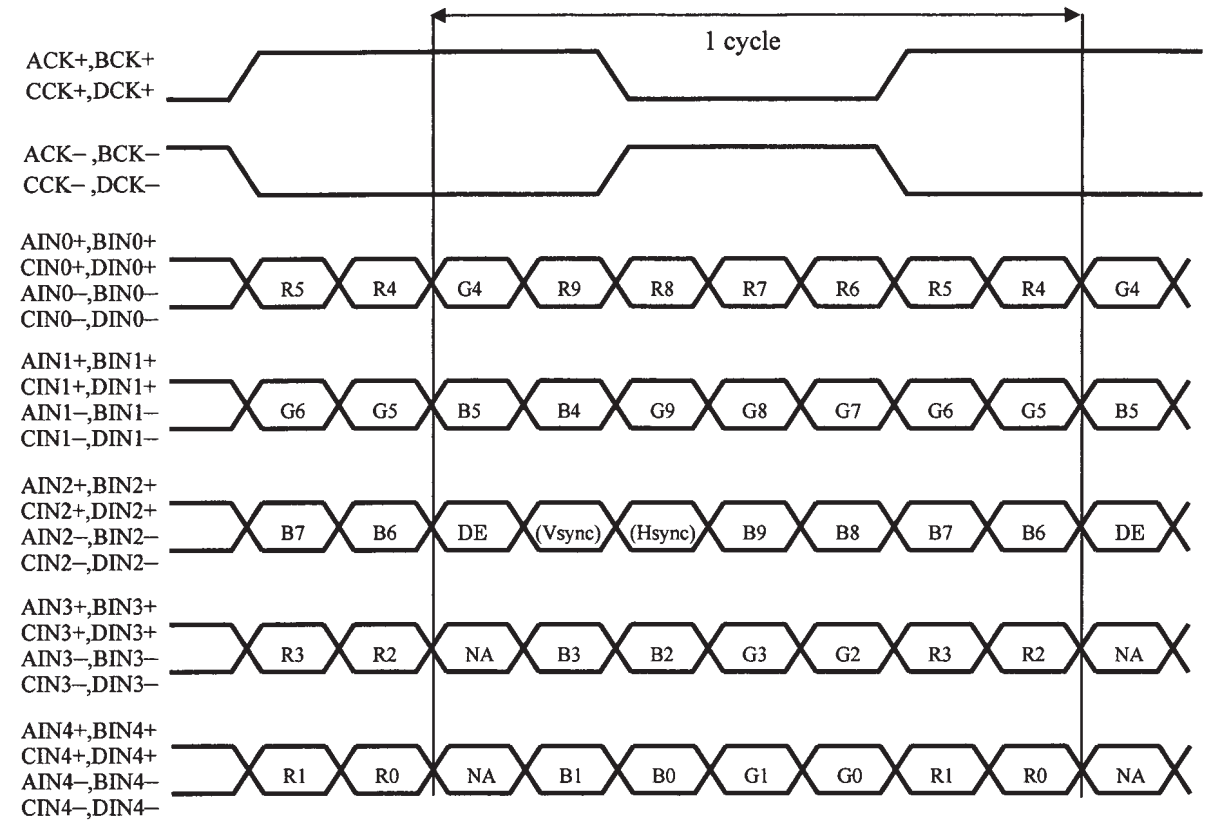


[Note 1]SELLVDS

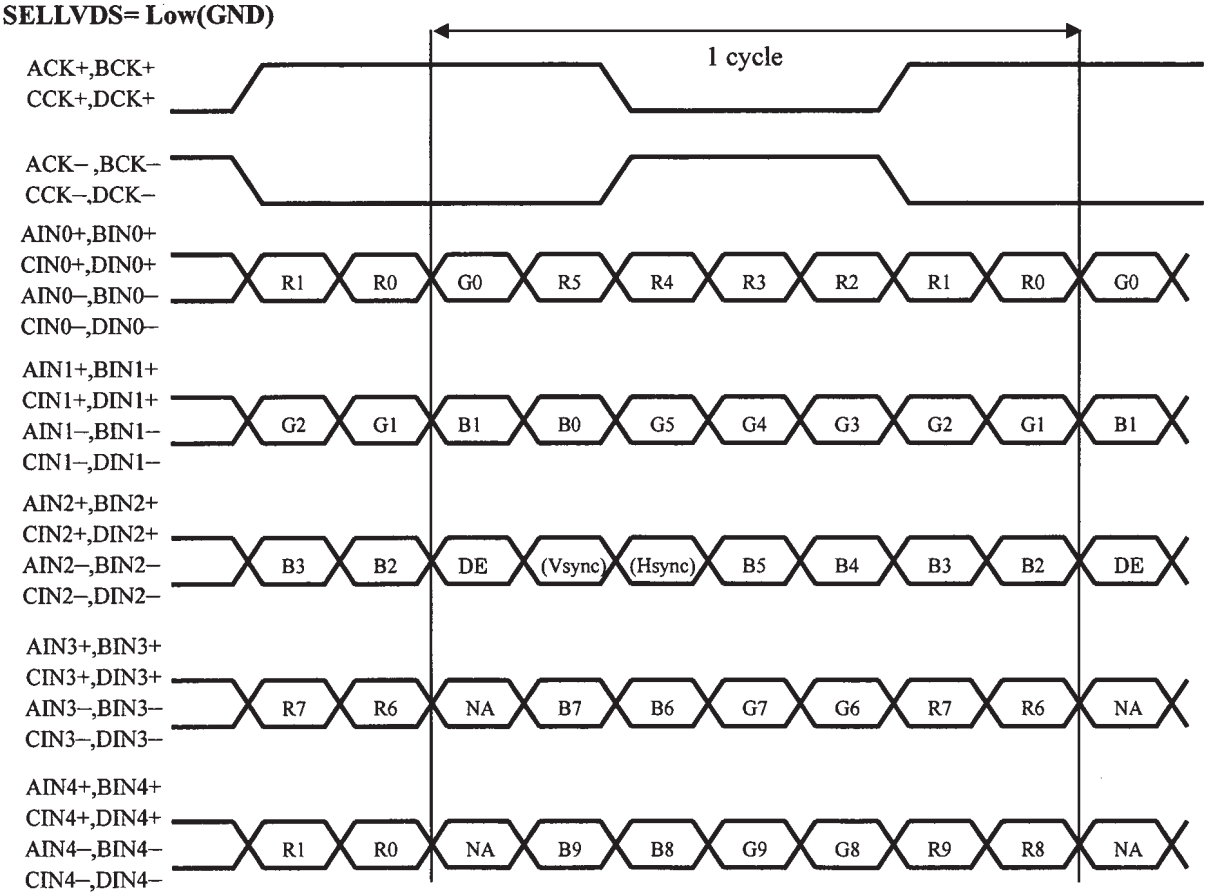
SELLVDS		
Data	L(GND) *	H(3.3V) * 【default】
TA0	R0(LSB)	R4
TA1	R1	R5
TA2	R2	R6
TA3	R3	R7
TA4	R4	R8
TA5	R5	R9(MSB)
TA6	G0(LSB)	G4
TB0	G1	G5
TB1	G2	G6
TB2	G3	G7
TB3	G4	G8
TB4	G5	G9(MSB)
TB5	B0(LSB)	B4
TB6	B1	B5
TC0	B2	B6
TC1	B3	B7
TC2	B4	B8
TC3	B5	B9(MSB)
TC4	(HSYNC)**	(HSYNC)**
TC5	(VSYNC)**	(VSYNC)**
TC6	DE(*)	DE(*)
TD0	R6	R2
TD1	R7	R3
TD2	G6	G2
TD3	G7	G3
TD4	B6	B2
TD5	B7	B3
TD6	N/A	N/A
TE0	R8	R0(LSB)
TE1	R9(MSB)	R1
TE2	G8	G0(LSB)
TE3	G9(MSB)	G1
TE4	B8	B0(LSB)
TE5	B9(MSB)	B1
TE6	N/A	N/A

*SELLVDS=H JEIDA Mode
*SELLVDS=L VESA Mode
NA: Not Available
(*)Since the display position is prescribed by the rise of DE(Display Enable)signal, please do not fix DE signal during operation at "High".
**HSYNC and VSYNC are not necessary

SELLVDS= High (3.3V)【default】



SELLVDS= Low(GND)



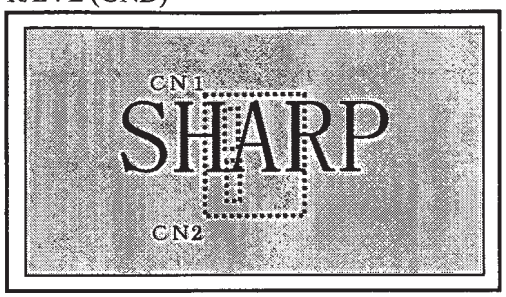
DE: Display Enable, Vsync: Vertical Sync, Hsync: Horizontal Sync

NA: Not Available (Fixed Low)

[Note 2]Display reversal function

Normal (Default)

R/L : L (GND)



Horizontal reverse image

R/L : H (3.3V)

[Note 3] O/S Setting

According as the surface temperature of the panel, enter the optimum 3 bit signal into pin No.2,3,4. Measuring the correlation between detected temperature by the sensor on PWB in users side and actual surface temperature of panel at center, convert the temperature detected by the sensor to the surface temperature of panel to enter the 3 bit temperature data.

Pin No.	Surface temperature of panel							
	0-5℃	5-10℃	10-15℃	15-20℃	20-25℃	25-30℃	30-35℃	35℃ and above
4	0	0	0	0	1	1	1	1
3	0	0	1	1	0	0	1	1
2	0	1	0	1	0	1	0	1

*0: Low level voltage (GND) 1: High level voltage(3.3V)

*For overlapping temperatures (such as 5℃,10℃,15℃,20℃,25℃, 30℃,35℃) select the optimum parameter, judging from the actual picture image.

4-2. Backlight driving

CN102(Interface signals and +3.3V DC power supply) (Shown in Fig.1-2)

Using connector: S09B-PASK-2 (J.S.T. Mfg Co.,Ltd.)

Mating connector: PAP-09V-S (J.S.T. Mfg Co.,Ltd.)

Pin No.	Symbol	Function	Remarks
1	GND	GND	
2	STB	Inverter ON/OFF	[Note 1]
3	OFL1	External PWM Dimming Phase1 (P-PWM)	
4	Reserved	Not Connect	
5	ERR	Error Detection. Normal:High/Abnormal:Low	[Note 2]
6	REG	Internal Oscillation Selection (Must be open or 0V)	
7	REG2	External PWM Dimming Selection (Must be 3.3V)	
8	Reserved	Not Connect	
9	OFL2	External PWM Dimming Phase2 (P-PWM)	

*GND of an inverter board is connected to GND of a module chassis and a liquid crystal panel drive part.

[Note 1] Inverter Control

Input voltage	Function
3.3V	Inverter: ON
0V	Inverter: OFF

[Note 2] Error Detection

Pin No.5 is used for the error detection of the inverter driving.

Output voltage	Inverter Driving
Low	Abnormal
High	Normal

CN101,CN401(+12V, +60V DC power supply) (Shown in Fig.1-2)

Using connector: S3P-VH (J.S.T. Mfg Co.,Ltd.)

Mating connector: VHR-3N (J.S.T. Mfg Co.,Ltd.)

Pin No.	Symbol	Function
1	V_{INV1}	60V
2	GND	GND
3	V_{INV2}	12V

*GND of an inverter board is connected to GND of a module chassis.

4-3. The back light system characteristics

The back light system is direct type with 36 CCFTs (Cold Cathode Fluorescent Tube).

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

The value mentioned below is at the case of one CCFT.

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Life time	T_L	-	60000	-	Hour	[Note]

[Note] • Lamp life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the condition of Ta=25 ℃ and brightness control(OFL1,2=100%).

• Above value is applicable when the long side of LCD module is placed horizontally (Landscape position).

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

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings	Unit	Remark
Input voltage (for Control)	V_I	Ta=25 ℃	-0.3 ~ 3.6	V	[Note 1]
12V supply voltage (for Control)	VCC	Ta=25 ℃	0 ~ + 14	V	
Input voltage (for Inverter)	STB OFL1, 2	Ta=25 ℃	0 ~ + 3.6	V	
60V supply voltage (for Inverter)	V_{INV1}	Ta=25 ℃	0 ~ +70	V	
12V supply voltage (for Inverter)	V_{INV2}	Ta=25 ℃	0~ +13.5	V	
Storage temperature	Tstg	-	-25 ~ +60	℃	[Note 2]
Operation temperature (Ambient)	Topa	-	0 ~ +50	℃	

[Note 1]SELLVDS, R/L, Frame,O/S_set, Temp1, Temp2, Temp3

[Note 2]Humidity 95%RH Max.(Ta≦40℃)

Maximum wet-bulb temperature at 39 ℃ or less.(Ta>40 ℃) / No condensation.

6. Electrical Characteristics

6-1. Control circuit driving

Ta=25 ℃

Parameter		Symbol	Min.	Typ.	Max.	Uniit	Remark
+12V supply voltage	Supply voltage	Vcc	11.0	12.0	12.6	V	[Note 1]
	Current	Icc	-	1.5	2.6	A	[Note 2]
		Iccs	0.3			A	[Note 7]
Permissible input ripple voltage		V_{RP}	-	-	100	mV_{P-P}	Vcc = +12.0V
Differential input threshold voltage	High	V_{TH}	-	-	100	mV	V_{CM} = +1.2V [Note]
	Low	V_{TL}	-100	-	-	mV	
Input Low voltage		V_{IL}	-	-	0.8	V	[Note 3]
Input High voltage		V_{IH}	2.0	-	3.6	V	
Input leak current (Low)		I_{IL}	-	-	400	μA	V_I = 0V [Note 4]
Input leak current (High)		I_{IH}	-	-	400	μA	V_I = 3.3V [Note 5]
Terminal resistor		R_T	-	100	-	Ω	Differential input

[Note]V_{CM}: Common mode voltage of LVDS driver.

[Note 1]

Input voltage sequences

0.1 ms < t1 ≦ 20ms

10 ms < t2

0 ms < t3

0 ms < t4

t5 ≧ 1s

t6 ≧ 0s

t7 ≧ 1s

t8 ≧ 1ms

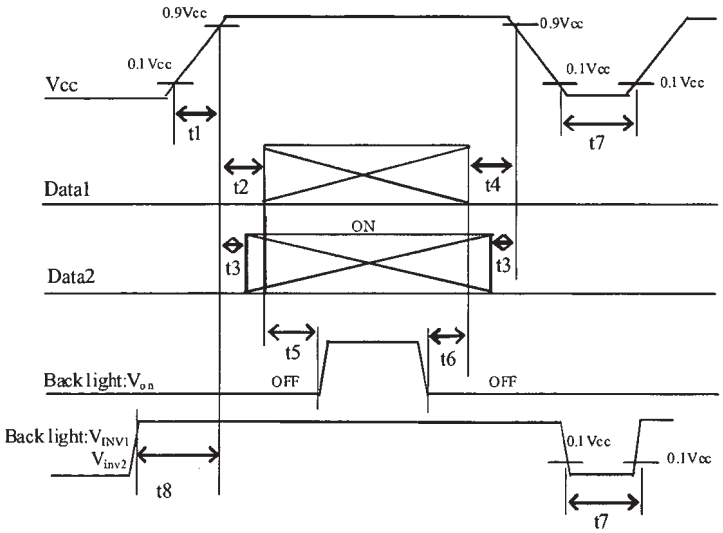
Dip conditions for supply voltage

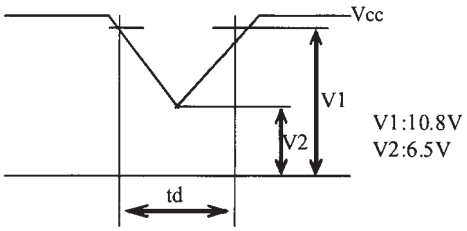
a) 6.5V ≦ Vcc < 10.8V

td ≦ 10ms

b) Vcc < 6.5V

Dip conditions for supply voltage is based on input voltage sequence.





※ Data1:ACK±, AIN0±, AIN1±, AIN2±, AIN3±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±, CCK±,CIN0±, CIN1±, CIN2±, CIN3±, CIN4±, DCK±, DIN0±, DIN1±, DIN2±, DIN3±, DIN4±

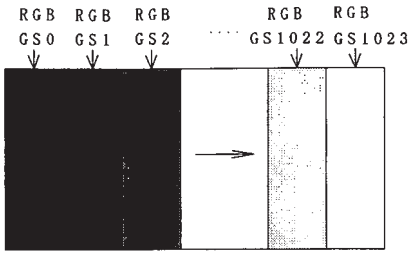
※ Data2:R/L,SELLVDS,FRAME,O/S_set,TEMP1,2,3

About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

[Note 2] Maximum current situation: white (RGB GS1023) (Vcc = +12.0V)

Typical current situation: 1024 gray-bar patterns. (Vcc = +12.0V)

The explanation of RGB gray scale is seen in section 8.



Vcc=12.0V
CK=74.25MHz
Th=7.41μs

[Note 3] FRAME, O/S_set, R/L, SELLVDS, TEMP3, TEMP2, TEMP1

[Note 4] FRAME, R/L

[Note 5] TEMP3, TEMP2, TEMP1, O/S_set, SELLVDS

[Note 6] ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±, CCK±,CIN0±, CIN1±, CIN2±, CIN3±, CIN4±, DCK±, DIN0±, DIN1±, DIN2±, DIN3±, DIN4±

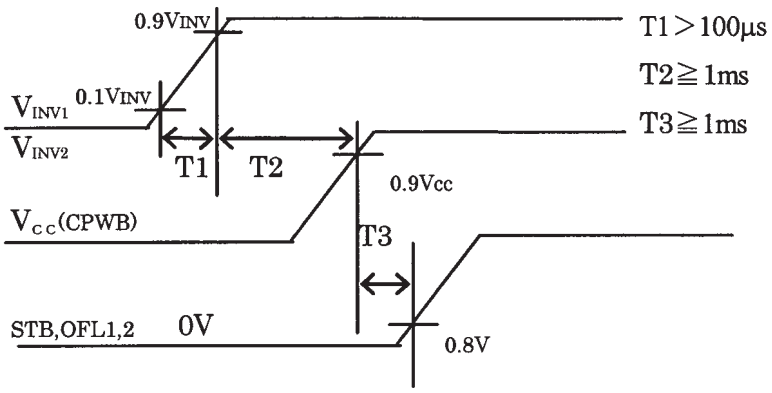
[Note 7] The minimum current value is a value when inputting only voltage (Vcc=+12V) and cutting an incoming signal (CK,ENAB,DATA)

6-2. Inverter driving for back light

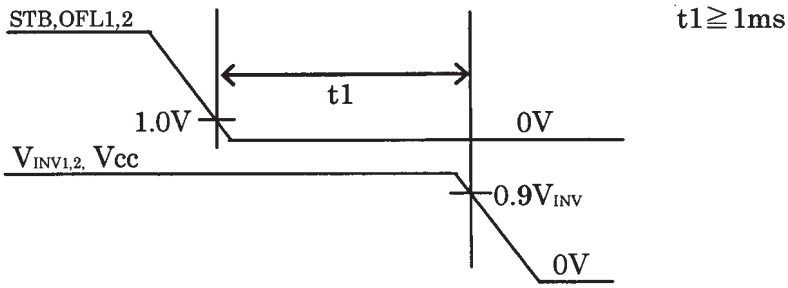
The back light system is direct type with 36 CCFTs (Cold Cathode Fluorescent Tube). Ta=25℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
+60V	Current dissipation	I_{INV1}	-	6.2	6.8	A	V_{INV1} = 60V STB= 3.3V OFL1,2 = 100% [Note 1,3]
		I_{INV2}	5.4	5.8	6.2	A	
	Supply voltage	V_{INV1}	54.0	60	66.0	V	
+12V	Supply voltage	V_{INV2}	10.8	12.0	13.2	V	Ityp =100mA
Permissible input ripple voltage		V_{RF}	-	-	600	mV_{p-p}	V_{INV1} = +60V
Input voltage (Low)		V_{ONL}	0	-	0.8	V	STB, OFL1,2 [Note 1]
Input voltage (High)		V_{ONH}	2.4	3.3	3.6	V	
Brightness control Duty vs Brightness level (Reference value)		-	20	→	100	%	[Note 2]
			10	→	100	%	

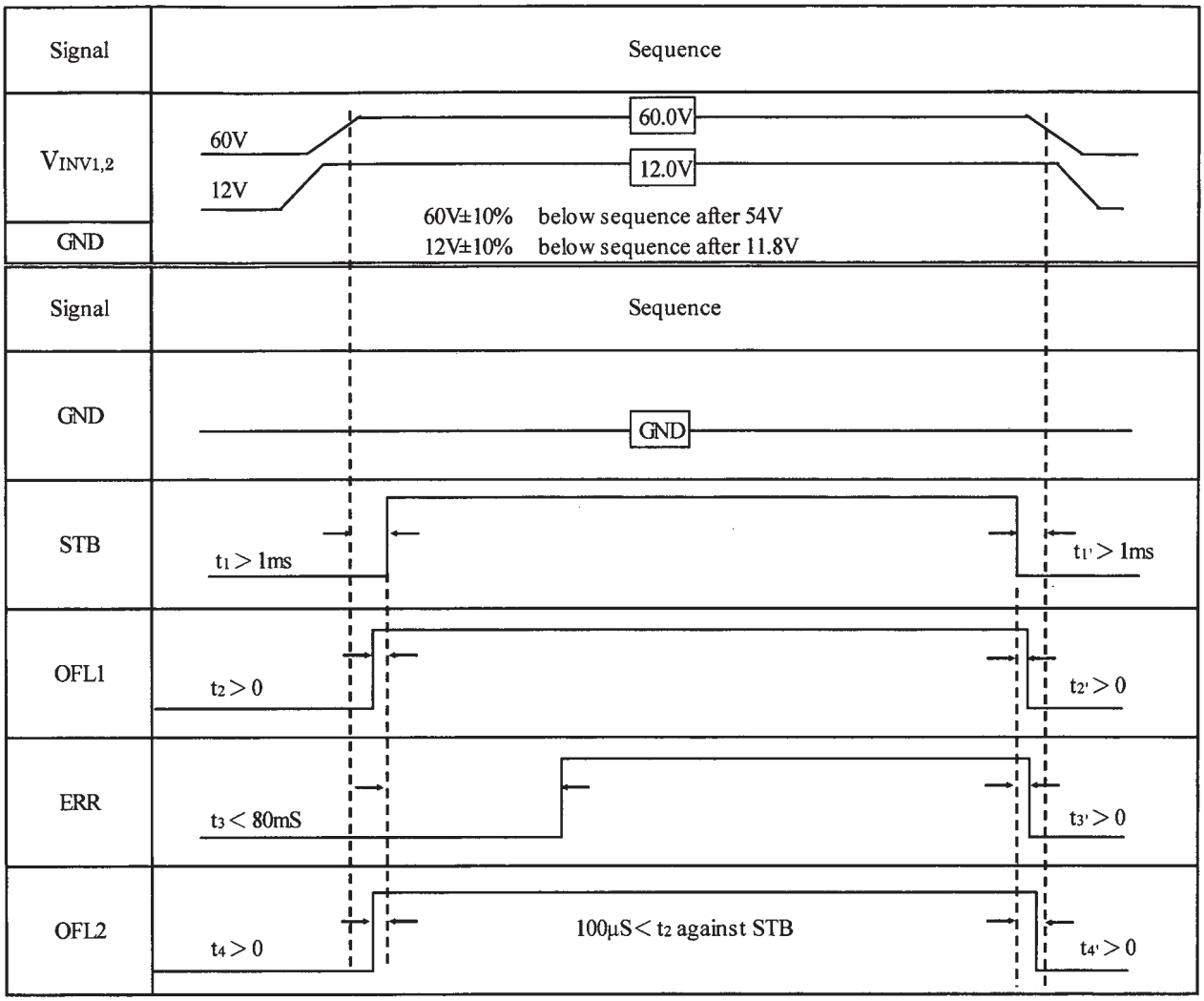
[Note 1] 1)V_{INV}-turn-on condition



2) V_{INV}-turn-off condition

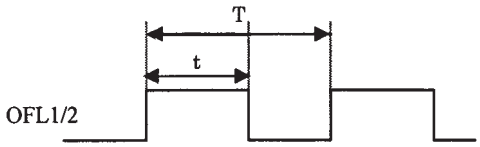


3) Power Sequence



[Note 2] Brightness Control (Pulse PWM Dimming)

Pin No.3, 9 is used for the control of the PWM duty with input pulse.



Ta = 25°C

		MIN	TYP	MAX	Remark
Pulse signal	[Hz]	140	-	350	
DUTY (t/T)	[%]	20	-	100	

[Note] There is a case that lamp mura may happen, depending on ambient temperature, in dimming. Minimum dimming level should be set according to your evaluation of actual display performance. (Minimum duty 60% at below 15℃)

[Note] In case of using Pulse Dimming, be careful so that the OFL1,2 signal (Pin 3,9) doesn't have glitch.

[Note 3] Current dissipation 1 : The regulation value within 120 minutes after the turning on.
(*It doesn't include Rush current.)

Current dissipation 2 : The regulation value since then of 120 minutes after the turning on.

[Note] The inverter unit is driving at the following drive frequency.

*The lamp drive frequency: 52kHz±0.5kHz

*The burst Brightness control drive frequency: 140Hz±10 Hz

The above drive frequency and the module drive frequency are cause and there is possibility that the backlight display problem occurs. When setting the drive frequency of the module, the interference with the above frequency make not occur.

7. Timing characteristics of input signals

7-1. Timing characteristics

Timing diagrams of input signal are shown in Fig.2.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	55	74.25	80	MHz	
Data enable signal	Horizontal period	TH	515	550	825	clock	
			6.94	7.41	11.1	μs	
	Horizontal period (High)	THd	480	480	480	clock	
	Vertical period	TV	1120	1125	1232	line	
			73.052	120	120.60	Hz	
	Vertical period (High)	TVd	1080	1080	1080	line	

【Note】-When vertical period is very long, flicker and etc. may occur.

-Please turn off the module after it shows the black screen.

-Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.

-As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.

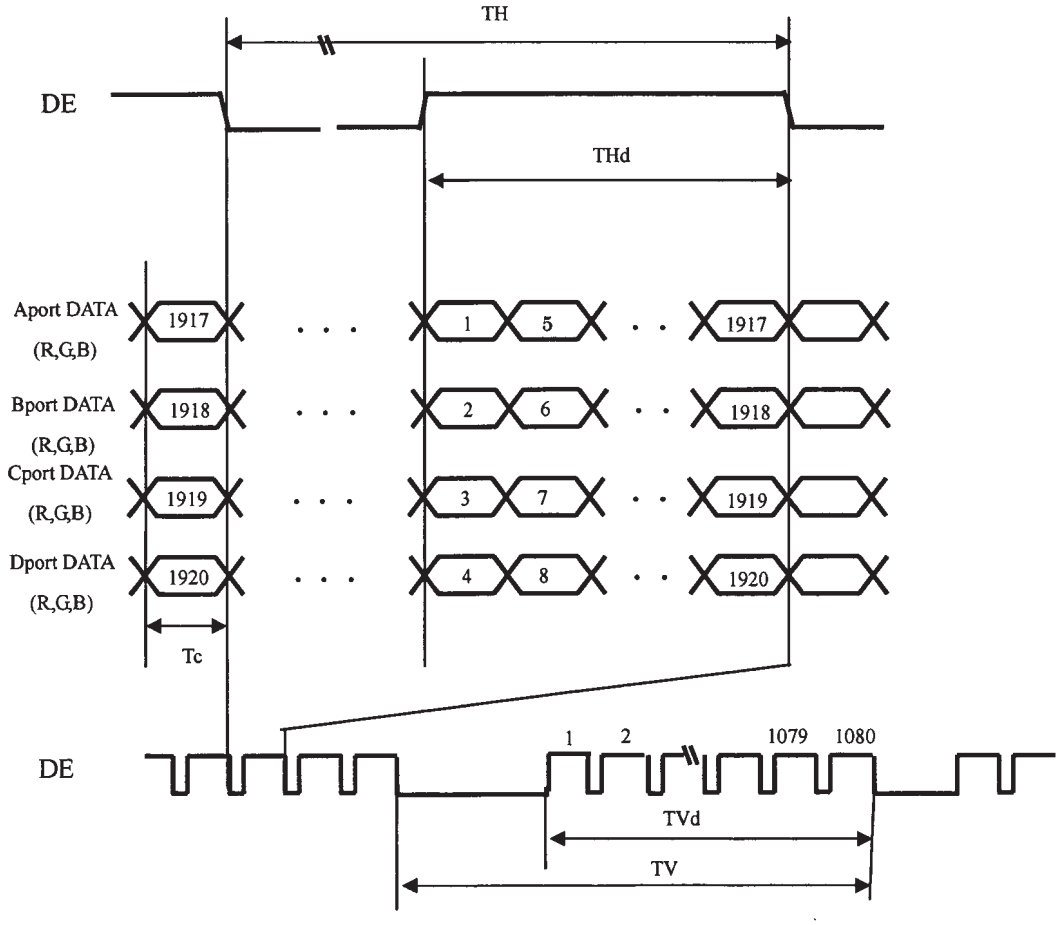


Fig.2 Timing characteristics of input signals

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

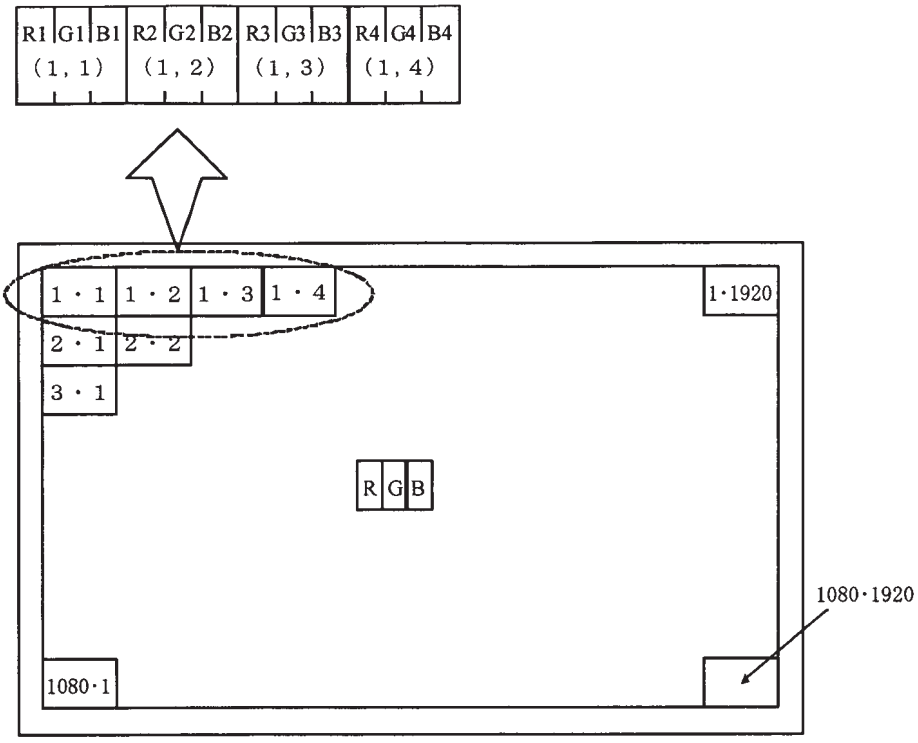


Fig. 3 Display position of Data (V,H)

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

	Colors & Gray scale	Gray Scale	Data signal																													
			R0	R1	R2	R3	R4	R5	R6	R7	R8	R9	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9
Basic Color	Black	–	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Green	–	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Cyan	–	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	–	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	–	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	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	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	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	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓										↓										↓					
	⇩	↓					↓										↓										↓					
	Brighter	GS1021	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS1022	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS1023	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓					↓										↓										↓					
	⇩	↓					↓										↓										↓					
	Brighter	GS1021	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	⇩	GS1022	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green	GS1023	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	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	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	⇩	↓					↓										↓										↓					
	⇩	↓					↓										↓										↓					
	Brighter	GS1021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1
	⇩	GS1022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
	Blue	GS1023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage.

Each basic color can be displayed in 1024 gray scales from 10 bits data signals. According to the combination of total 30 bits data signals, about the 1073 million-color display can be achieved on the screen

9. Optical characteristics

Ta=25℃, Vcc = 12.0V, V_{INV1} = 24.0V, 120Hz-mode, V_{INV2} = 12.0V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ 21 θ 22	CR≧10	80	88	-	Deg.	[Note1,4]
	Vertical	θ 11 θ 12		80	88	-	Deg.	
Contrast ratio		CRn	θ =0 deg.	1500	2000	-		[Note2,4] OFL1,2=100%
Response time		τ DRV			4		ms	[Note3,4,5] OFL1,2=100%
Luminance of white		x		0.254	0.284	0.314	-	[Note 4] OFL1,2=100%
		y		0.266	0.296	0.326	-	
Luminance of red		x		0.616	0.646	0.676	-	
		y		0.307	0.337	0.367	-	
Luminance of green		x		0.251	0.281	0.311	-	
		y		0.577	0.607	0.637	-	
Luminance of blue		x		0.113	0.143	0.173	-	
		y		0.041	0.071	0.101	-	
Luminance of white		Y_{L1}		360	450		cd/m^2	OFL1,2=100% [Note 4]
Luminance uniformity		δ w		-	-	1.4		[Note 6]

Measurement condition : Set the value of V_{BRT} to maximum luminance of white.

*The measurement shall be executed 120 minutes after lighting at rating.

【Note】 The optical characteristics are measured using the following equipment.

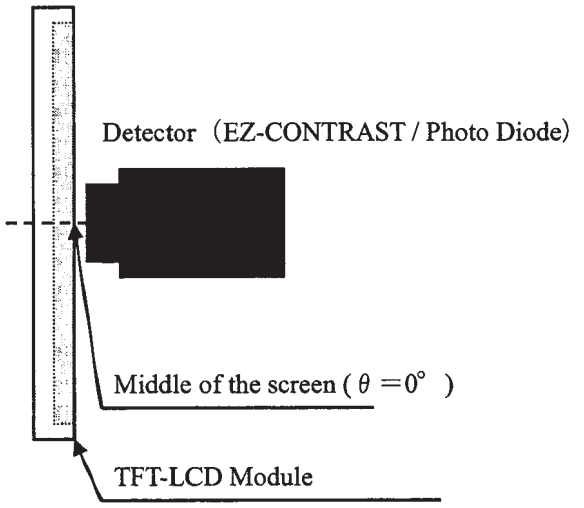


Fig.4-1 Measurement of viewing angle range and response time.
(Viewing angle range : EZ-CONTRAST
Response time : Photo Diode)

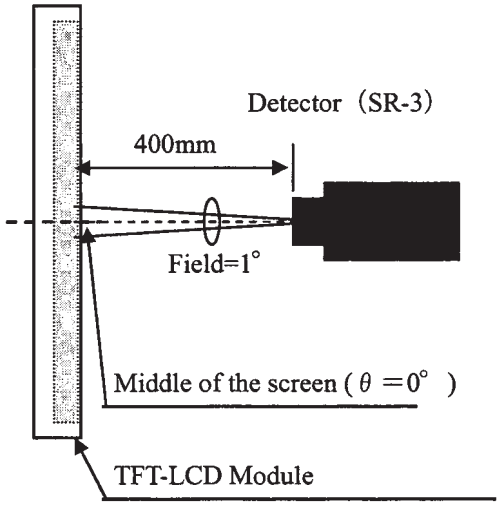
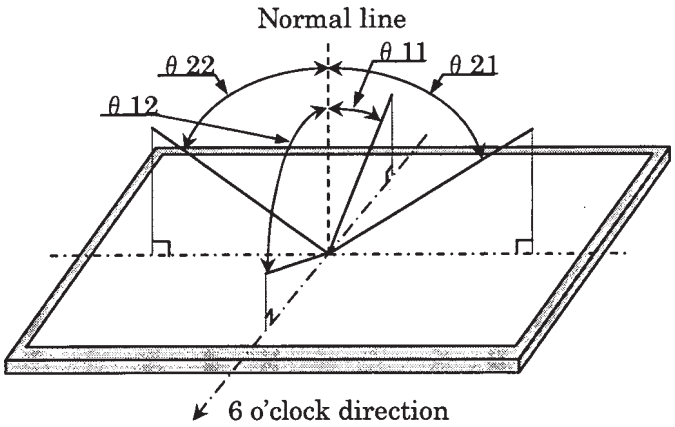


Fig.4-2 Measurement of Contrast, Luminance, Chromaticity .

[Note 1]Definitions of viewing angle range :



[Note 2]Definition of contrast ratio :

The contrast ratio is defined as the following.

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

[Note 3]Definition of response time

3-1. Response time

The response time (τ_{Drv}) is defined as the following figure and shall be measured by switching the input signal for "five luminance ratio(0%, 25%, 50%, 75%, 100%)" and "five luminance ratio(0%, 25%, 50%, 75%, 100%)".

	0%	25%	50%	75%	100%
0%		tr:0%-25%	tr:0%-50%	tr:0%-75%	tr:0%-100%
25%	td:25%-0%		tr:25%-50%	tr:25%-75%	tr:25%-100%
50%	td:50%-0%	td:50%-25%		tr:50%-75%	tr:50%-100%
75%	td:75%-0%	td:75%-25%	td:75%-50%		tr:75%-100%
100%	td:100%-0%	td:100%-25%	td:100%-50%	td:100%-75%	

t*:x-y...response time from level of gray(x) to level of gray(y)

$\tau_{Drv} = \Sigma(t^*:x\text{-}y)/20$

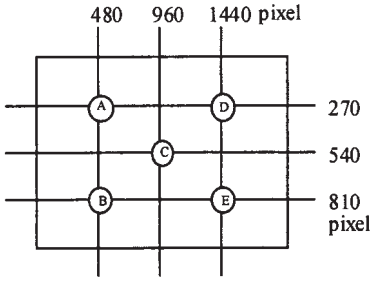
[Note 4]This shall be measured at center of the screen.

[Note 5] Response time is the value when O/S driving is used at typical input time value .

[Note 6]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. Handling Precautions of the module

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

b) This product is using the parts (inverter, CCFT etc), which generate the high voltage. Therefore, during operating, please don't touch these parts.

c) Brightness control voltage is switched for "ON" and "OFF", as shown in Fig.5. Voltage difference generated by this switching, ΔV_{INV}, may affect a sound output, etc. when the power supply is shared between the inverter and its surrounding circuit. So, separate the power supply of the inverter circuit with the one of its surrounding circuit.

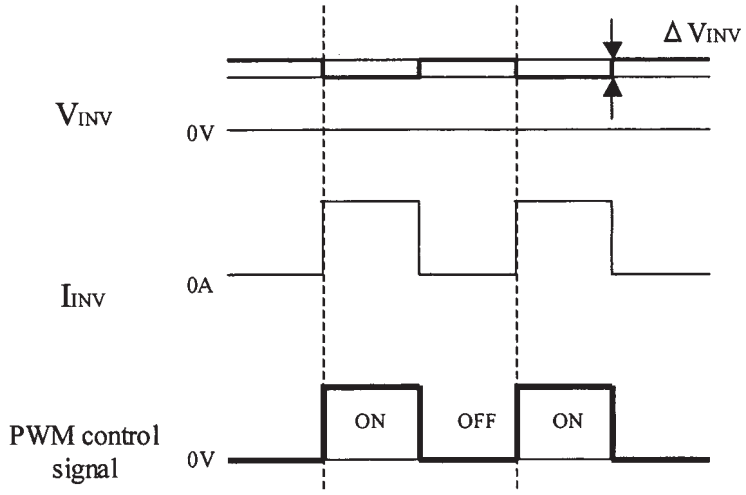


Fig.5 Brightness control voltage.

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

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

f) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.

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

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

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

j) The module has some printed circuit boards (PCBs) on the back side, take care to keep them form any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.

k) Observe all other precautionary requirements in handling components.

l) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc. So, please avoid such design.

m) When giving a touch to the panel at power on supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.

n) 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.

o) Lamps of the backlight are placed horizontally to the long side of LCD module. So make sure that the LCD module are placed horizontally (landscape position), as lifetime of backlight becomes shorter if placed at atilt.

p) Make sure that the LCD module is operated within specified temperature and humidity.Measures against dust, water, vibration, and heat radiation, etc. are required at the cabinet or equipment side.And image retention may occur if same fixed pattern is displayed for a long time. In some cases, it may notdisappear.

Please consider the design and operating environment

11. Packing form

a) Piling number of cartons: 2 maximum (Don't load on top of anything if the carton is not filled with full modules)

b) Packing quantity in one carton: 4 pcs.

c) Carton size: 1620 (W) × 600 (D) × 1078 (H)

d) Total mass of one carton filled with full modules: 148kg(typ)

e) Packing Form are shown in Fig 6.

12. Reliability test item

No.	Test item	Condition
1	High temperature storage test	Ta=60℃ 240h
2	Low temperature storage test	Ta=-25℃ 240h
3	High temperature and 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-operation)	Frequency: 10~57Hz/Vibration width (one side): 0.075mm : 57~500Hz/Acceleration: 9.8 m/s^2 Sweep time: 11 minutes Test period: 3 hours (1h for each direction of X, Y, Z)
7	Shock test (non-operation)	Maximum acceleration: 294m/s^2 Pulse width: 11ms, sinusoidal half wave Direction: +/-X, +/-Y, +/-Z, once for each direction.
8	ESD	At the following conditions, it is a thing without incorrect operation and destruction. (1)Non-operation: Contact electric discharge +/-10kV Non-contact electric discharge+/-20kV (2)Operation Contact electric discharge +/-8kV Non-contact electric discharge +/-15kV Conditions: 150pF、330ohm

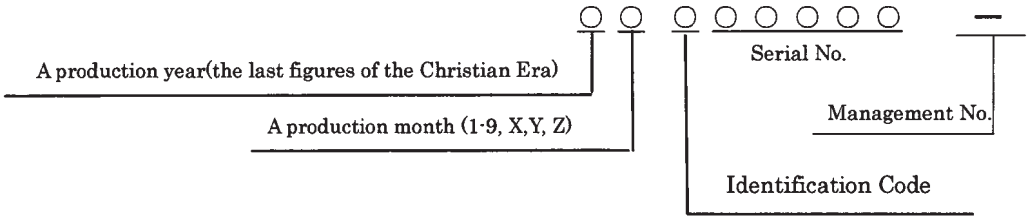
【Result evaluation criteria】

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

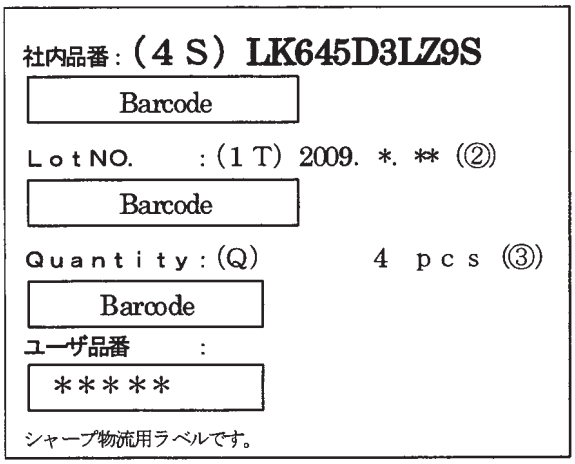
13. Others

1)Lot No. Label ;

The label that displays SHARP,product model(LK645D3LZ9S),a product number is stuck on the back of the module.



2) Packing Label



① Management No. (LK645D3LZ9S)

② Lot No. (Date)

③ Quantity

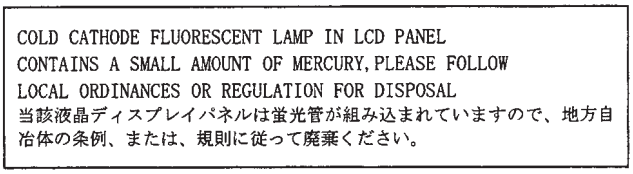
3) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

4) Disassembling the module can cause permanent damage and should be strictly avoided.

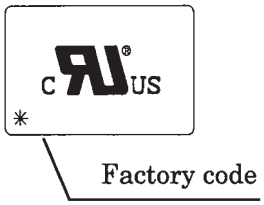
5) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

6) The chemical compound, which causes the destruction of ozone layer, is not being used.

7) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury. Please follow local ordinances or regulations for disposal. It is displaying the label in the module back.



8) This LCD is appropriate to UL. Below figure shows the UL label.



9) This module is corresponded to RoHS

10) The chemical compound, which causes the destruction of ozone layer, is not being used.

11) Rust on the module is not taken up a problem.

12) Appearance quality and standard are referred to the outgoing incoming inspections.

13) Rust on the module is not taken up a problem.

14. Carton storage condition

Temperature	0℃ to 40℃
Humidity	95%RH or less
Reference condition	: 20℃ to 35℃ , 85%RH or less (summer) : 5℃ to 15℃ , 85%RH or less (winter) • the total storage time (40℃,95%RH) : 240h or less
Sunlight	Be sure to shelter a product from the direct sunlight.
Atmosphere	Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.
Notes	Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment
Storage life	1 year

LD-K21207-25

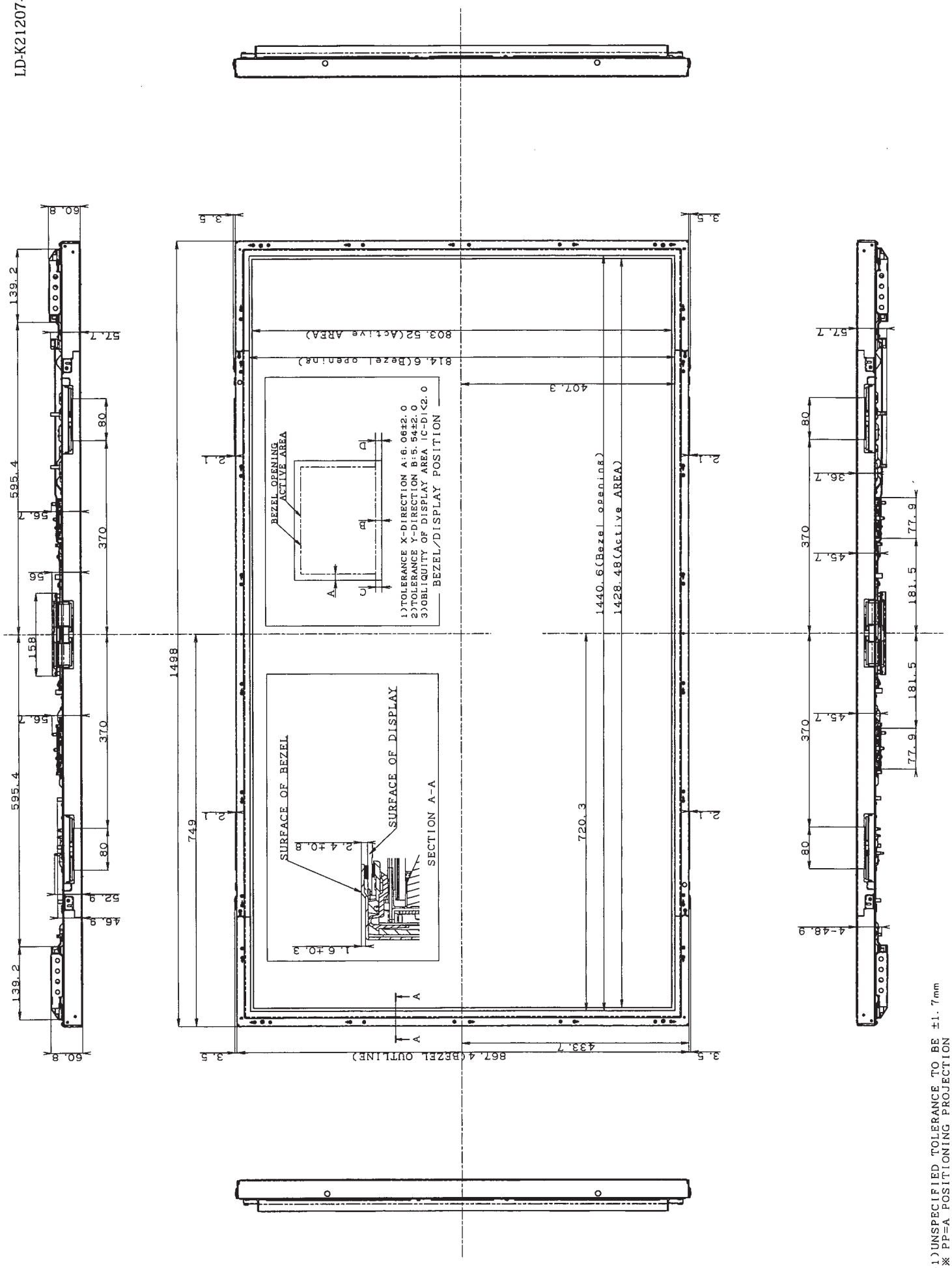


Fig. 1-1 Outline Dimensions

Note1)UNSPECIFIED TOLERANCE TO BE ±1.7mm
※ PP=A POSITIONING PROJECTION

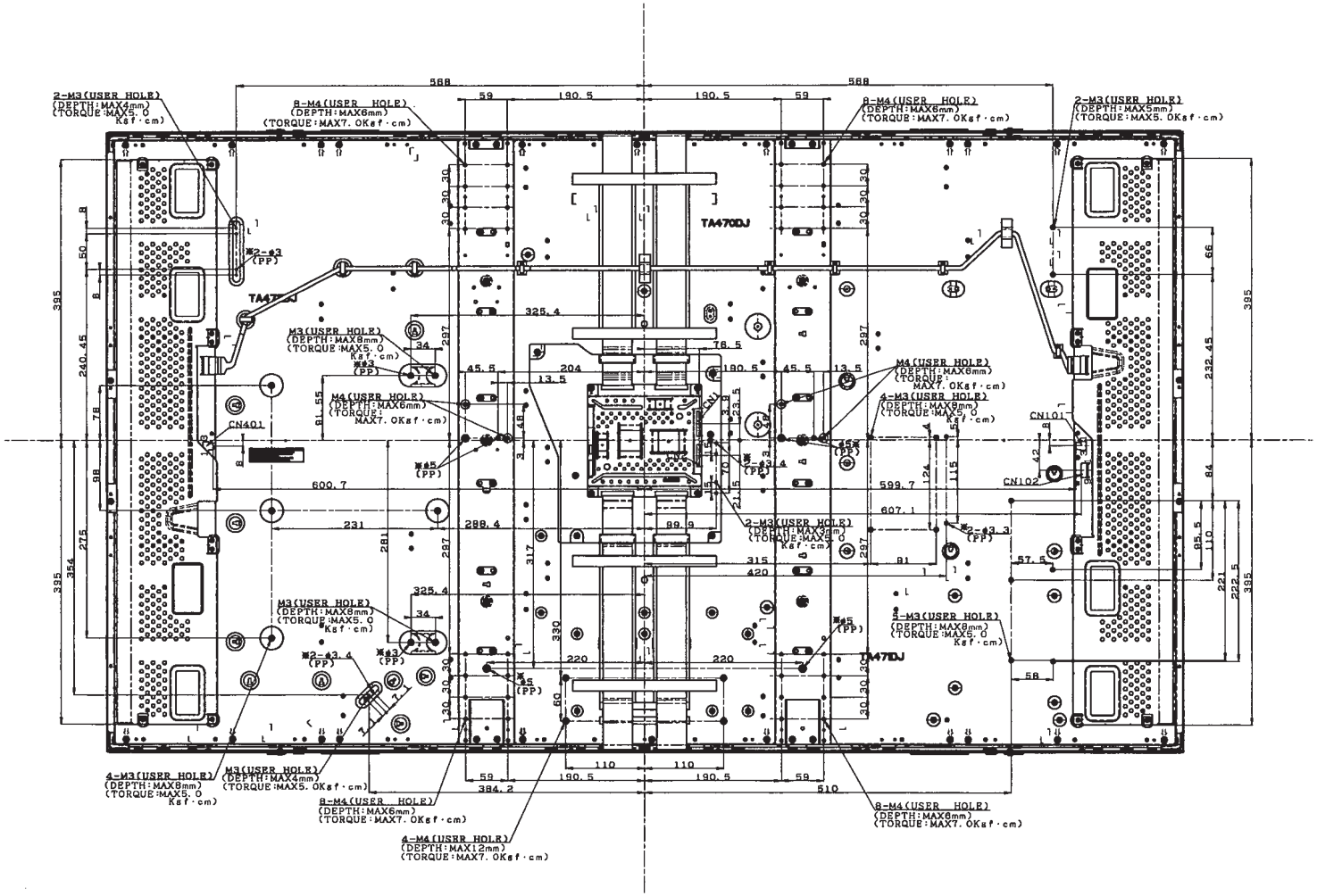


Fig. 1—2 Outline Dimensions

Note1)UNSPECIFIED TOLERANCE TO BE ±1.7mm
※ PP=A POSITIONING PROJECTION

ITEM	Material
CARTON(Top)	Cardboard
CARTON(Bottom)	Cardboard
PAD(Top A)	PS
PAD(Top B)	PS
PAD(Bottom A)	PS
PAD(Bottom B)	PS
PAD(Bottom C)	PS
PALETTE	Heat treatment woods
ANTISTATIC BAG	PE (t = 20μ)

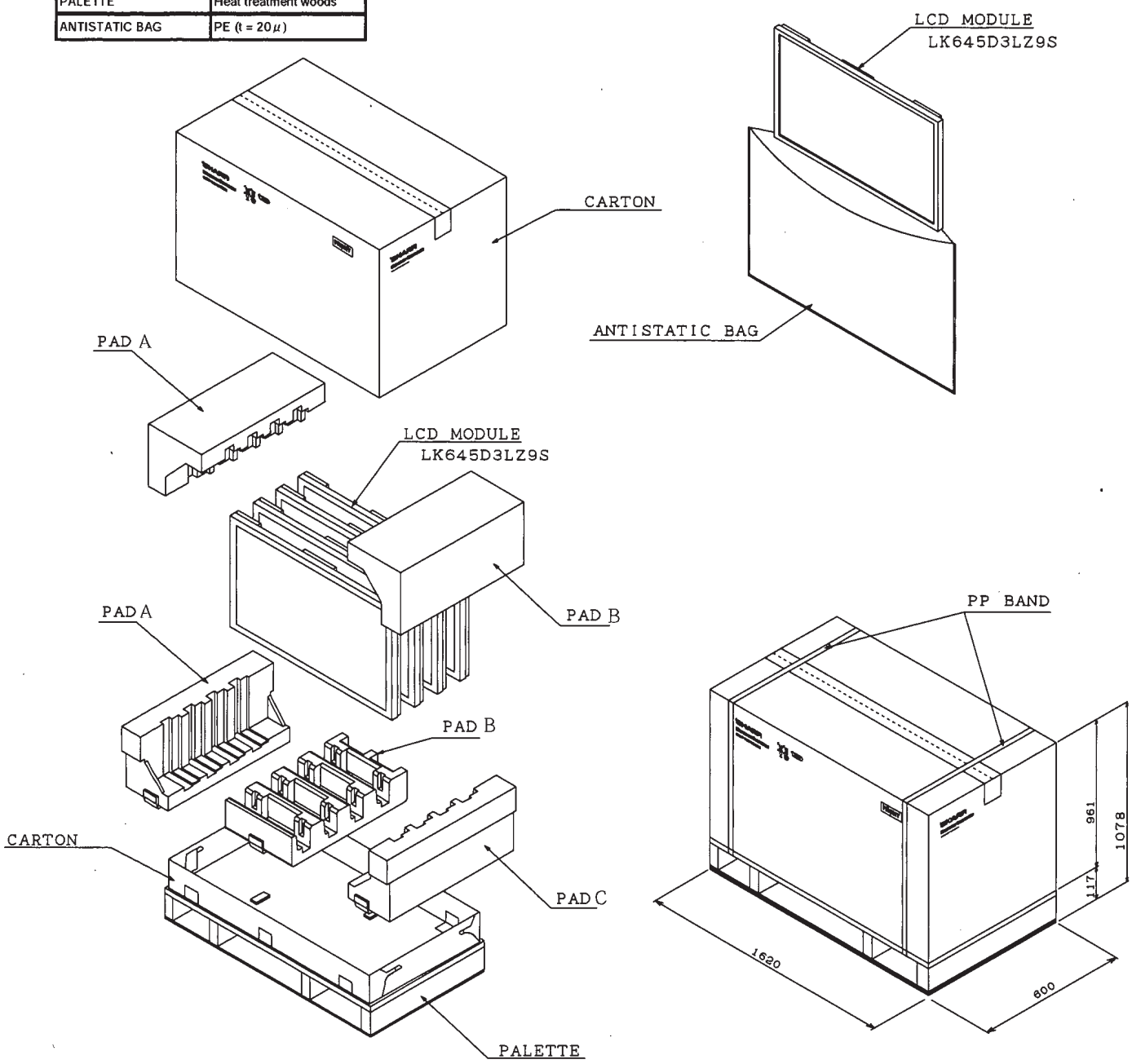


Fig. 6 Packing Form