

**SHARP**

No.	<b>LD-K20477</b>
DATE	Nov. 25. 2008

TECHNICAL LITERATURE  
FOR  
TFT - LCD module

MODEL No. **LK400D3LA24**

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**DEVELOPMENT DEPARTMENT 1  
ADVANCED TECHNOLOGY DEVELOPMENT CENTER  
AVC LIQUID CRYSTAL DISPLAY GROUP  
SHARP CORPORATION**



## 1. Application

This technical literature applies to the color 40.0" TFT-LCD module LK400D3LA24

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## 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 one billion 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 CCFT. (+24V 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	101.609 ( Diagonal )	cm
	40.0 ( Diagonal )	inch
Active area	885.6(H) x 498.15 (V)	mm
Pixel Format	1920(H) x 1080(V) ( 1pixel = R + G + B dot )	pixel
Pixel pitch	0.46125(H) x 0.46125 (V)	mm
Pixel configuration	R, G, B vertical stripe	
Display mode	Normally black	
Unit Outline Dimensions (*1)	952.0 (W) x 551.0 (H) x 50.8 (D)	mm
Mass	TBD	kg
Surface treatment	Low-Haze Anti Glare Hard coating : 3H	

(\*1) Outline dimensions are shown in Fig.1 (excluding protruding portion)

## 4. Input Terminals

### 4.1. TFT panel driving

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

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 or equivalent device

Pin No.	Symbol	Function	Remark
1	GND		
2	Reserved	It is required to set non-connection(OPEN)	Pull up 3.3V
3	Reserved	It is required to set non-connection(OPEN)	Pull up 3.3V
4	Reserved	It is required to set non-connection(OPEN)	Pull up 3.3V
5	FRAME	Frame frequency setting 1:120Hz 0:100Hz [Note 1]	Pull down : (GND)
6	O/S set	O/S operation setting H:O/S_ON, L:O/S_OFF [Note 3]	Pull up 3.3V
7	SELLVDS	Select LVDS data order [Note 2]	Pull down : (GND)
8	Reserved	It is required to set non-connection(OPEN)	Pull down : (GND)
9	Reserved	It is required to set non-connection(OPEN)	Pull down : (GND)
10	Reserved	It is required to set non-connection(OPEN)	Pull down : (GND)
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		
43	GND		
44	GND		
45	GND		
46	GND		

47	Reserved (VCC)	(+12V Power Supply)	
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)

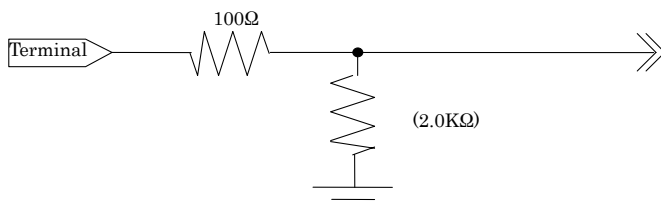
Using connector : FI-RE41S-HF (Japan Aviation Electronics Ind., Ltd.)

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		
6	Reserved		
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 1] The equivalent circuit figure of the terminal



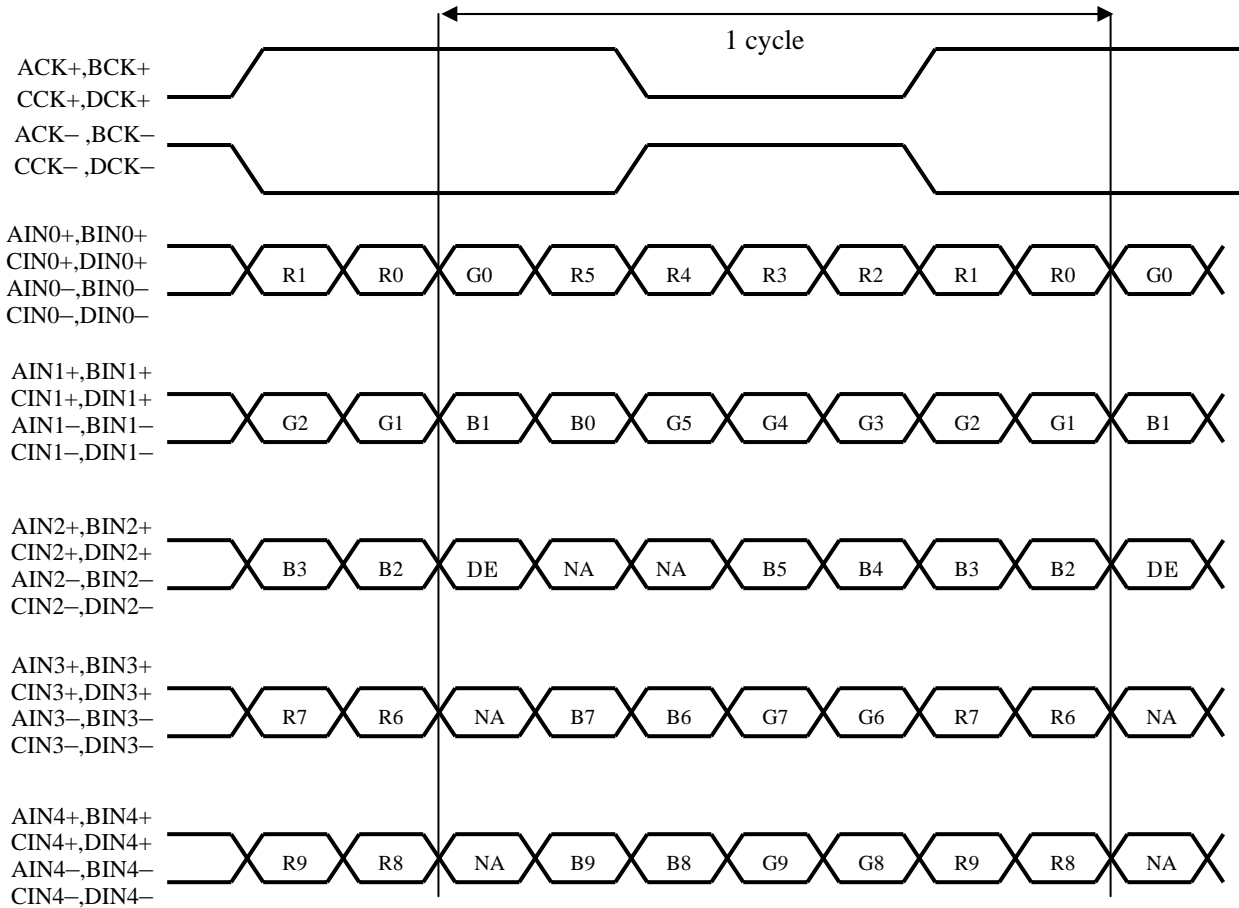
[Note 2] LVDS Data order

SELLVDS		
Data	L(GND) or Open [VESA]	H(3.3V) [JEIDA]
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	NA	NA
TC5	NA	NA
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

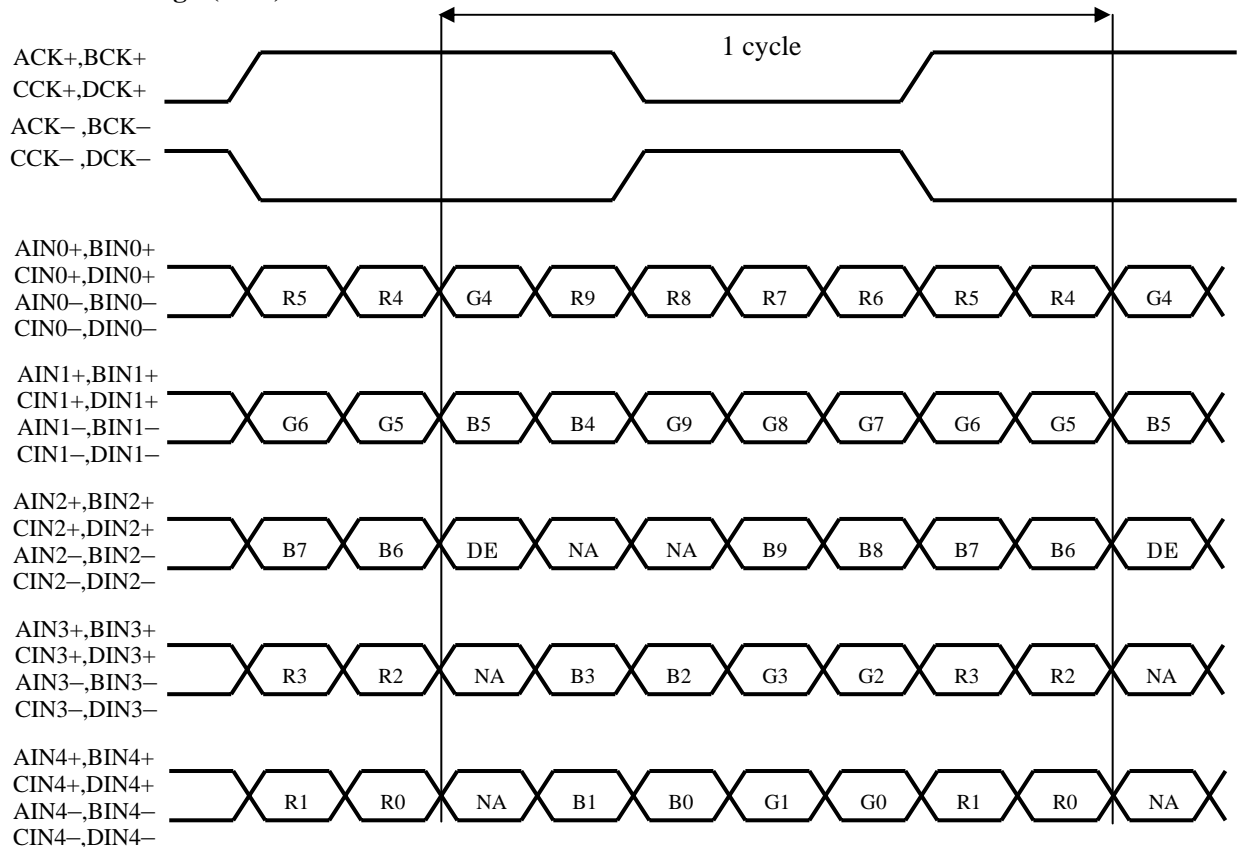
NA: Not Available

(\*) Since the display position is prescribed by the rise of DE(Display Enable) signal, please do not fix DE signal during operation at "High".

**SELLVDS= Low (GND) or OPEN**

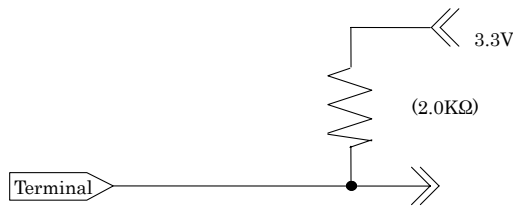


**SELLVDS= High (3.3V)**

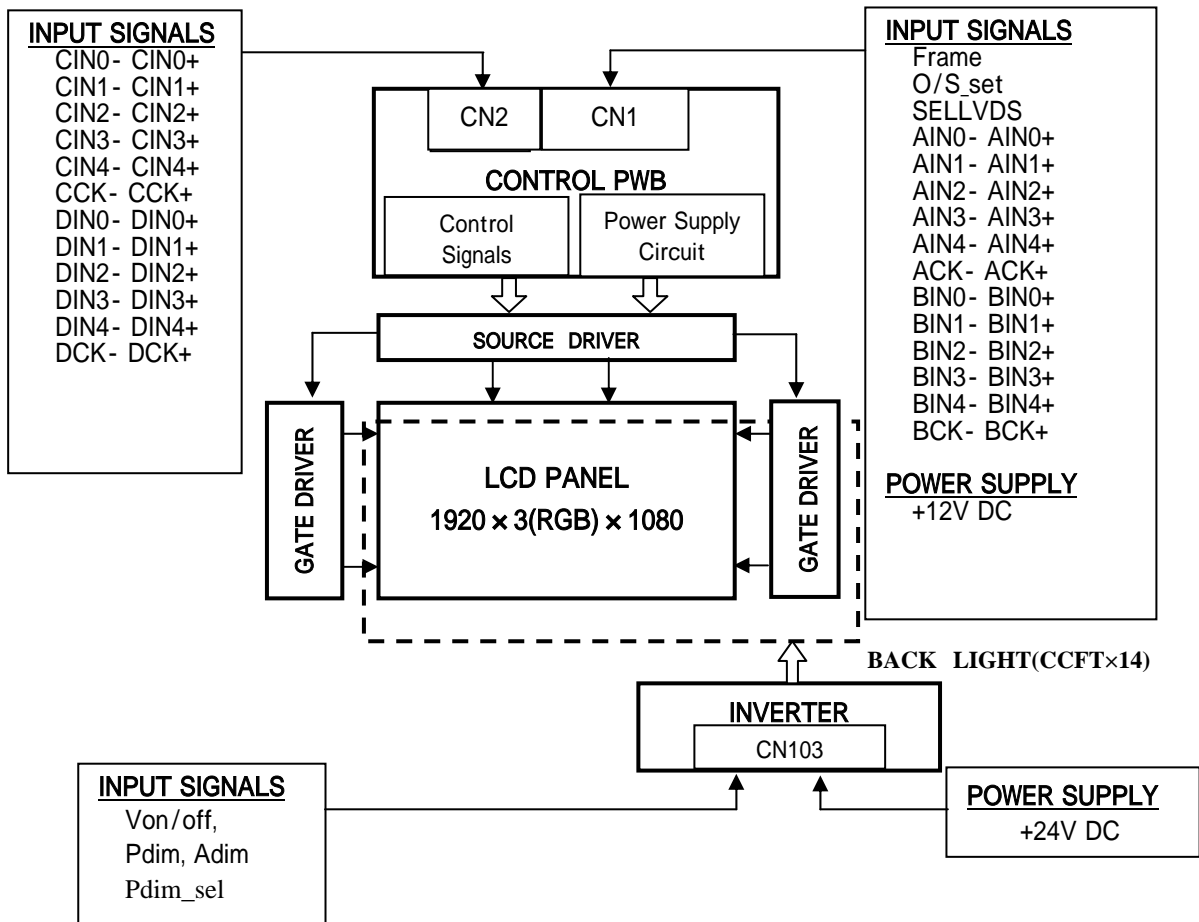


DE: Display Enable, NA: Not Available (Fixed Low)

[Note 3] The equivalent circuit figure of the terminal



4.2. Interface block diagram



## 4.3. Backlight driving

CN103 (+24V DC power supply and inverter control)

Using connector: S14B-PH-K-S (LF) (JST)

Mating connector: PHR-14 (JST)

Pin No.	Symbol	Function	Default(OPEN)	Input Impedance	Remark
1	V <sub>INV</sub>	+24V	-		
2	V <sub>INV</sub>	+24V	-		
3	V <sub>INV</sub>	+24V	-		
4	V <sub>INV</sub>	+24V	-		
5	V <sub>INV</sub>	+24V	-		
6	GND		-		
7	GND		-		
8	GND		-		
9	GND		-		
10	GND		-		
11	Adim or ERR	Brightness Control 1 or Error Detection	(Adim)1.65V: typ.Value	(Adim)333K ohm	[Note 1]
12	Von/off	Inverter ON/OFF	Inverter OFF	75K ohm	[Note 2]
13	Pdim	Brightness Control 2	3.3V : pull up Brightness 100%	1.02M ohm	[Note 4]
14	Pdim_sel	PWM selection	3.3V : pull up Selected Analog PWM	67K ohm	[Note 3]

[Note 1]Brightness Control 1 (Amplitude Dimming)

Pin No.11 is used for the dimming control with input voltage from 0 to 3.3V.

Ta=25°C

	MIN	TYP	MAX	Function
Input voltage [V]	0	1.65	3.3	0V:Dark – 3.3V:Bright
Brightness ratio [ % ]	96	100	104	

[Note 2] Inverter ON/OFF

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

[Note 3] Brightness Control2 selection

Pin No.14 is used for the selection of dimming control for Pdim pin (Pin No.13).

Input voltage	Pdim
0V	Pulse dimming
3.3V	Analog dimming

[Note 4] Brightness Control2

## 1. Analog Dimming

Brightness control2 is regulated by analog input voltage (0V to 3.3V).

Ta=25

	MIN	TYP	MAX	Function
Input voltage [Pdim]	0V	<->	3.3V	0V: Dark - 3.3V: Bright
[Reference] Brightness ratio [ % ]	(10)	<->	100	

[Note] PWM frequency : (TBD±10)Hz

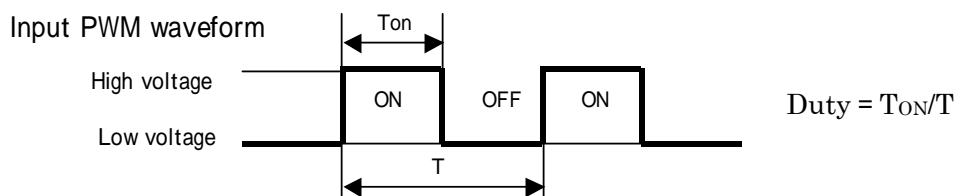
[Note] There is a case that lamp mura may happen, depending on ambient temperature and dimming.

Dimming level should be set according to your evaluation of actual display performance.

(Minimum input voltage TBD at below 15 )

## 2. Pulse Dimming

Pin No.13 is used for the control of the PWM duty with input pulse from (100Hz to 350Hz).



		MIN	TYP	MAX	Remark
Pulse signal frequency	[Hz]	(100)	TBD	(350)	
DUTY( $T_{ON}/T$ )	[%]	(15)	<->	100	Ta=25
Dimming level (luminance ratio)	[%]	(10)	<->	100	Ta=25 Pulse signal=(TBD)Hz

[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 TBD at below 15 )

[Note] In case of using Pulse Dimming, be careful so that the Pdim signal (Pin 13) doesn't have glitch.

#### 4.4. The back light system characteristics

The back light system is direct type with 14 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 <sub>L</sub>	-	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°C and brightness control(V<sub>BRT</sub>=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 <sub>I</sub>	Ta=25 °C	-0.3 ~ 3.6	V	[Note 1]
12V supply voltage (for Control)	VCC	Ta=25 °C	0 ~ + 14	V	
Input voltage (for Inverter)	V <sub>ON</sub> V <sub>BRT</sub> V <sub>BRT_sel</sub>	Ta=25 °C	0 ~ + 6	V	
24V supply voltage (for Inverter)	V <sub>INV</sub>	Ta=25 °C	0 ~ +29	V	
Storage temperature	Tstg	-	-25 ~ +60	°C	[Note 2]
Operation temperature (Ambient)	Topa	-	0 ~ +50	°C	

[Note 1] SELLVDS, FRAME, O/S\_set,

[Note 2] Humidity 95%RH Max.(Ta 40°C)

Maximum wet-bulb temperature at 39 °C or less.(Ta>40°C)

No condensation.

## 6. Electrical Characteristics

### 6.1. Control circuit driving

Ta=25 °C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
+12V supply voltage	Supply voltage	V <sub>CC</sub>	11.4	12	12.6	V	[Note 1]
	Current dissipation	I <sub>CC</sub>	-	TBD	TBD	A	[Note 2]
	Inrush current	I <sub>RUSH1</sub>	-	TBD	-	A	t <sub>1</sub> =500us [Note 7]
		I <sub>RUSH2</sub>	-	TBD	-	A	t <sub>1</sub> >5ms [Note 7]
Permissible input ripple voltage	V <sub>RP</sub>	-	-	100	mV <sub>P-P</sub>	V <sub>CC</sub> = +12.0V	
Differential input threshold voltage	High	V <sub>TH</sub>	-	-	100	mV	V <sub>CM</sub> = +1.2V [Note 6]
	Low	V <sub>TL</sub>	-100	-	-	mV	
Input Low voltage	V <sub>IL</sub>	0	-	1.0	V	[Note 3]	
Input High voltage	V <sub>IH</sub>	2.3	-	3.3	V		
Input leak current (Low)	I <sub>IL1</sub>	-	-	400	μA	V <sub>I</sub> = 0V [Note 4]	
	I <sub>IL2</sub>	-	-	40	μA	V <sub>I</sub> = 0V [Note 5]	
Input leak current (High)	I <sub>IH1</sub>	-	-	40	μA	V <sub>I</sub> = 3.3V [Note 4]	
	I <sub>IH2</sub>	-	-	400	μA	V <sub>I</sub> = 3.3V [Note 5]	
Terminal resistor	R <sub>T</sub>	-	100	-	Ω	Differential input	

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

[Note 1]

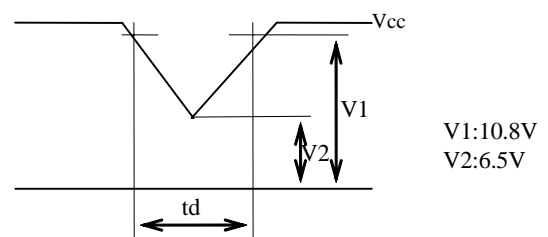
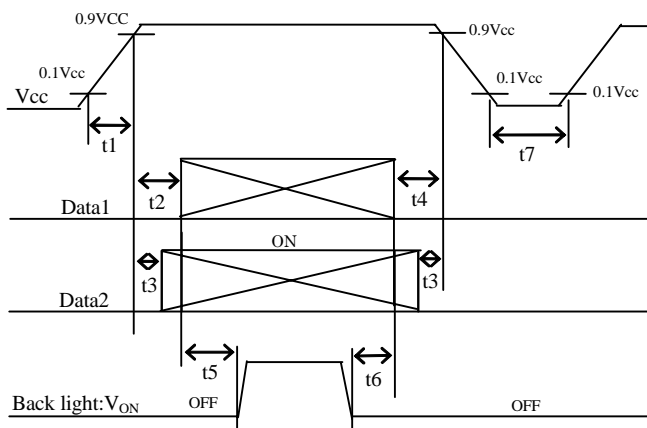
Input voltage sequences

0 < t <sub>1</sub>	20ms
10 < t <sub>2</sub>	20ms
10 < t <sub>3</sub>	50ms
0 < t <sub>4</sub>	1s
t <sub>5</sub>	200ms
t <sub>6</sub>	0
t <sub>7</sub>	300ms

Dip conditions for supply voltage

- a) 6.5V    V<sub>CC</sub> < 10.8V  
t<sub>d</sub>    10ms
- b) V<sub>CC</sub> < 6.5V

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



Data1: ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±

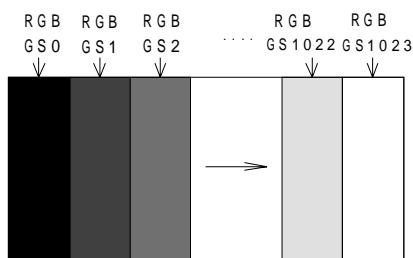
\*V<sub>CM</sub> voltage pursues the sequence mentioned above

Data2: SELLVDS, FRAME, O/S\_SET

[Note] 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] 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] SELLVDS, FRAME, O/S\_SET

[Note 4] O/S\_SET

[Note 5] FRAME, SELLVDS

[Note 6] ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±

[Note 7] Vcc12V inrush current waveform

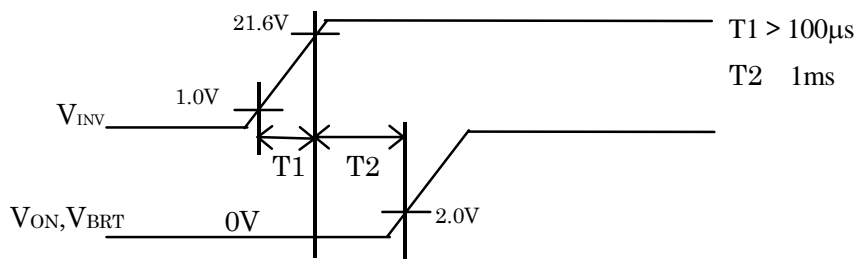
TBD

## 6.2. Inverter driving for back light

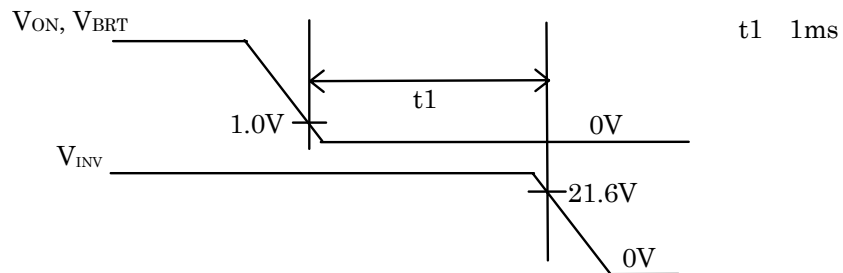
The back light system is direct type with 14 CCFTs (Cold Cathode Fluorescent Tube).

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
+ 24V	Current dissipation 1	$I_{INV1}$	-	TBD	TBD	$V_{INV} = 24V, T_a = 25^\circ C$ Adim = 1.65V or open DUTY = 100% [Note 1,2]
	Current dissipation 2	$I_{INV2}$	-	(6.875)	TBD	
	Inrush current	$I_{RUSH}$	-	-	TBD	
	Supply voltage	$V_{INV}$	22.8	24.0	25.2	
Permissible input ripple voltage	$V_{RF}$	-	-	1.0	$V_{p-p}$	$V_{INV} = +24.0V$
Input voltage (Low)	$V_{ONL}$	0	-	1.0	V	$V_{ON}, Adim, Pdim, Pdim\_sel$
Input voltage (High)	$V_{ONH}$	2.3	-	3.6	V	

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



2)  $V_{INV}$ -turn-off condition



[Note 2] Current dissipation 1 : Definition within 60 minutes after turn on. (Rush current is excluded.)

Current dissipation 2 : Definition more than 60minutes after turn on.

## 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)	(1350)	1125	(1400)	line
73.052			100	120	123.00	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.

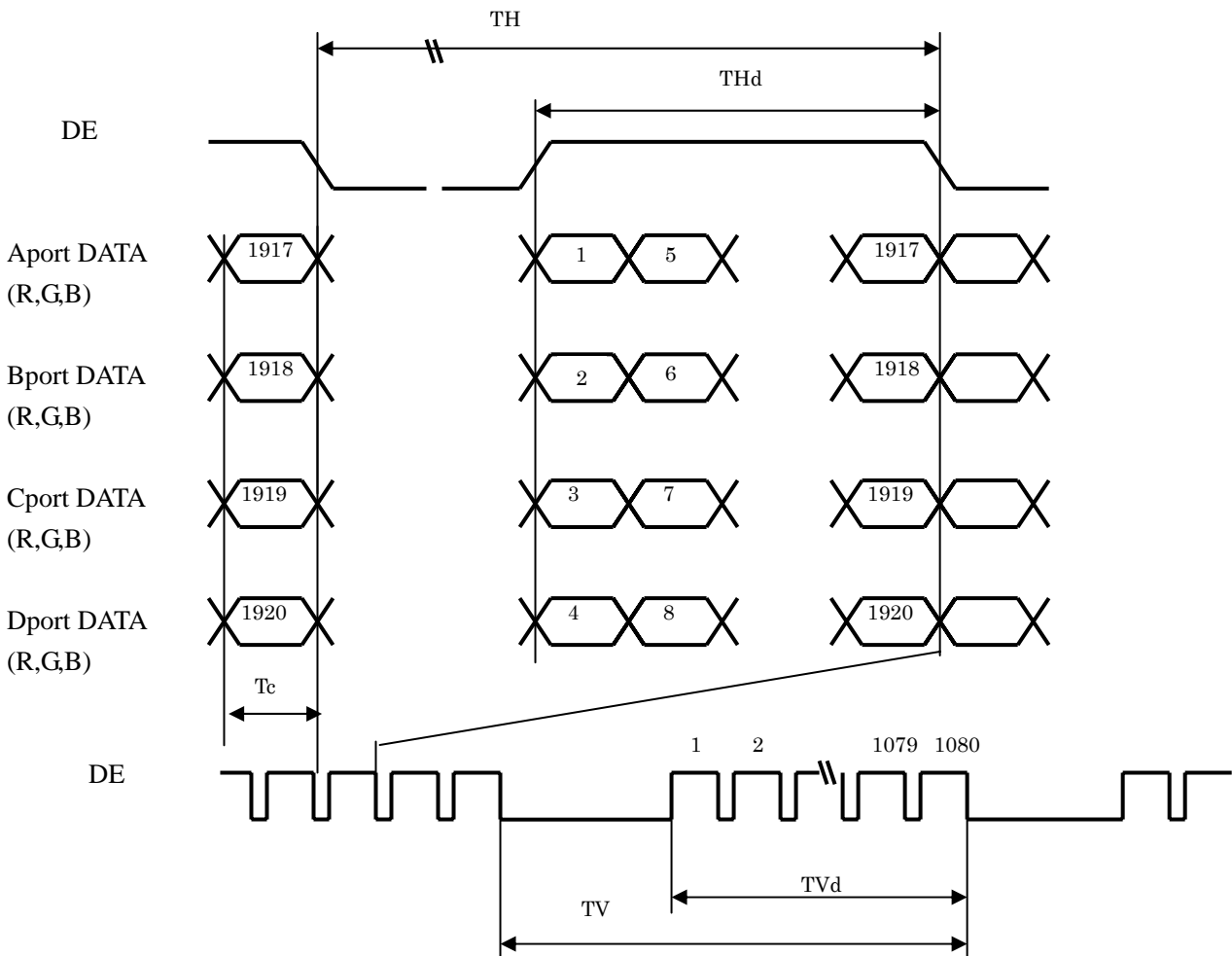
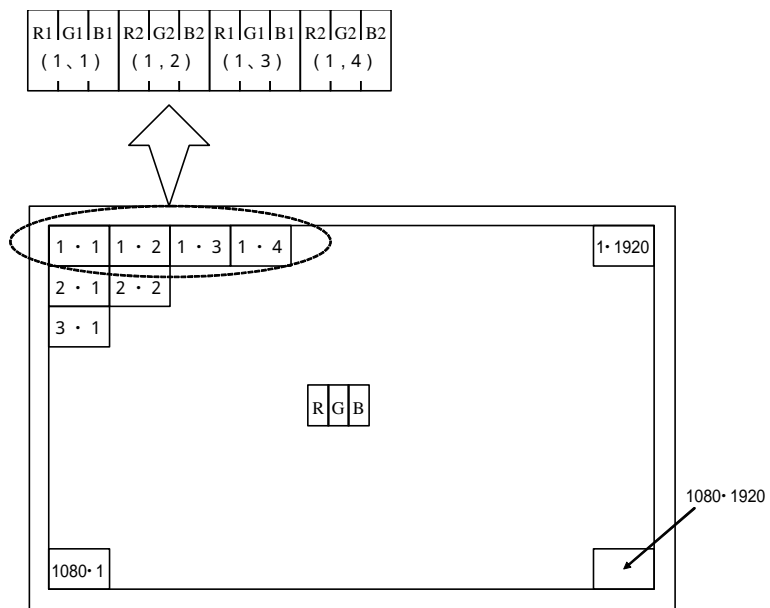


Fig.2 Timing characteristics of input signals

## 7.2. Input data signal and display position on the screen



Display position of Dat (V,H)



## 9. Optical characteristics

Ta=25°C, V<sub>CC</sub>=12.0V, V<sub>INV</sub>=24.0V, V<sub>BRT</sub>=100% , Timing:60Hz(typ. value)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	$\theta_{21}$ $\theta_{22}$	CR 10	70	88	-	Deg.	[Note1,4]
	Vertical	$\theta_{11}$ $\theta_{12}$		70	88	-	Deg.	
Contrast ratio		CRn	$\theta=0$ deg.	2250	3000	-		[Note2,4]
Response time		$\tau_{DRV}$			4	8	ms	[Note3,4,5]
MPRT(BET)		-			12	-	ms	[Note7]
Chromaticity	White	x		(0.248)	(0.278)	(0.308)	-	[Note4]
		y		(0.255)	(0.285)	(0.315)	-	
	Red	x			(TBD)		-	
		y			(TBD)		-	
	Green	x			(TBD)		-	
		y			(TBD)		-	
Blue	x			(TBD)		-		
	y		(TBD)		-			
Gamma		-		2.2	-	-		
Luminance	White	Y <sub>L</sub>		400	500	-	cd/m <sup>2</sup>	
Luminance uniformity	White	$\delta w$				1.25		[Note 6]

Measurement condition: Set the value of V<sub>BRT</sub> to maximum luminance of white.

\*The measurement shall be executed 60 minutes after lighting at rating.

[Note]The optical characteristics are measured using the following equipment.

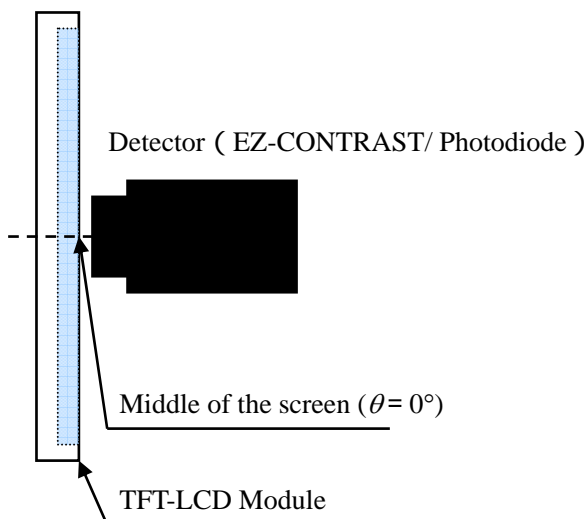


Fig.4-1 Measurement of viewing angle range and Response time.

Viewing angle range: EZ-CONTRAST

Response time: Photodiode

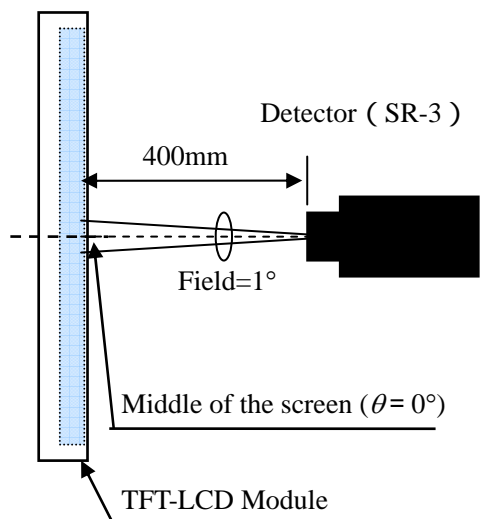
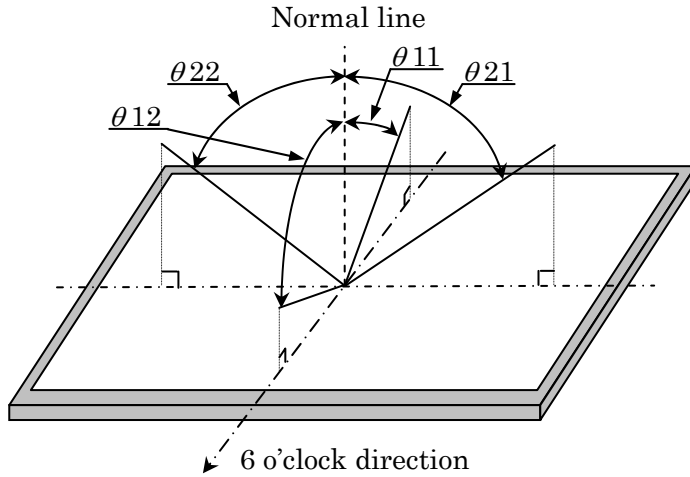


Fig.4-2 Measurement of Contrast, Luminance, Chromaticity.

[Note 1]Definitions of viewing angle range :



[Note 2]Definition of contrast ratio :

The contrast ratio is defined as the following.

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

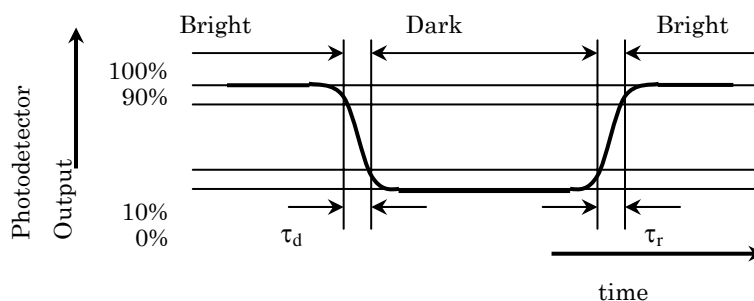
[Note 3]Definition of response time

The response time ( $\tau_d$  and  $\tau_r$ ) is defined as the following figure and shall be measured by switching the input signal for “any level of gray (0%, 25%, 50%, 75% and 100%)” and “any level of gray (0%, 25%, 50%, 75% and 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)

$$\tau_r = \Sigma(\text{tr}:x-y)/10, \tau_d = \Sigma(\text{td}:x-y)/10$$



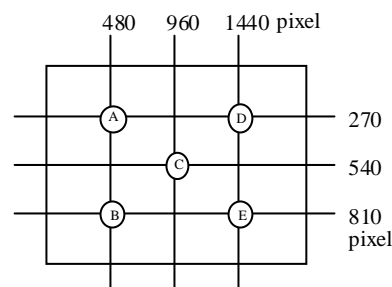
[Note 4]This shall be measured at center of the screen.

[Note 5] This value is valid 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)

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



[Note 7] Moving Picture Response Time (BET);

MPRT (BET) is measured by MPRT-1000 (OTSUKA ELECTRONICS co.,Ltd.)

## 10. Handling Precautions of the module

- Be sure to turn off the power supply when inserting or disconnecting the cable.
- This product is using the parts (inverter, CCFT etc), which generate the high voltage. Therefore, during operating, please don't touch these parts.
- Brightness control voltage is switched for "ON" and "OFF", as shown in Fig.4. Voltage difference generated by this switching,  $\Delta V_{INV}$ , 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.

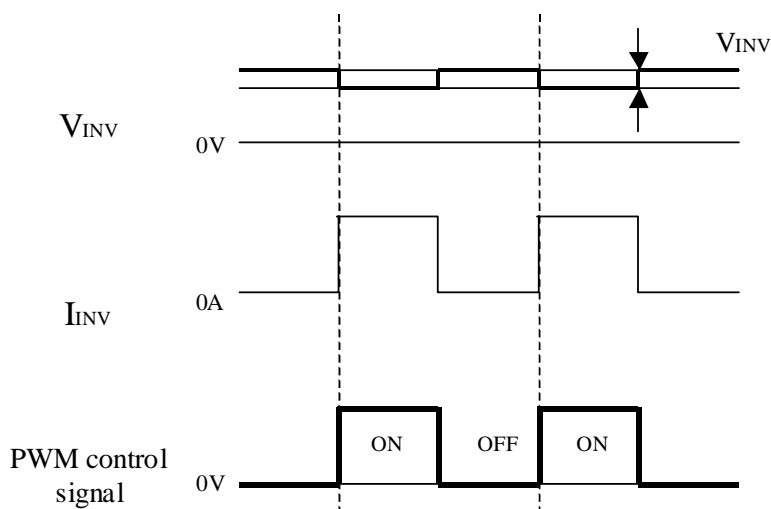


Fig.4 Brightness control voltage.

\*Since inverter board's GND is not connected to the frame of the LCD module, please connect it with the Customer's GND of inverter power supply.

- Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- Since the front polarizer is easily damaged, pay attention not to scratch it.
- Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 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 from 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) This LCD module is designed to prevent dust from entering into it. However, there would be a possibility to have a bad effect on display performance in case of having dust inside of LCD module. Therefore, please ensure to design your TV set to keep dust away around LCD module.

## 11. Packing form

- a) Piling number of cartons : TBD
- b) Packing quantity in one carton : TBD.
- c) Carton size : TBD
- d) Total mass of one carton filled with full modules : TBD

## 12. Reliability test item

No.	Test item	Condition
1	High temperature storage test	Ta=60°C 240h
2	Low temperature storage test	Ta=-25°C 240h
3	High temperature and high humidity operation test	Ta=40°C ; 95%RH 240h (No condensation)
4	High temperature operation test	Ta=50°C 240h
5	Low temperature operation test	Ta=0°C 240h
6	Vibration test (non-operation)	Frequency: 10~57Hz/Vibration width (one side): 0.075mm : 58~500Hz/Acceleration: 9.8 m/s <sup>2</sup> 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 <sup>2</sup> 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 ;

TBD

2) Packing Label

TBD

3) Adjusting volume has been set optimally before shipment, so do not change any adjusted value.

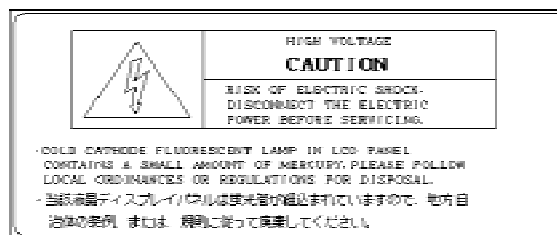
If adjusted value is changed, the specification may not be satisfied.

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

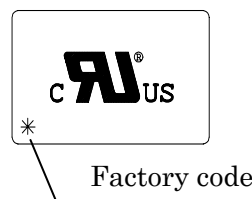
5) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

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. This sentence is displayed on the backside of the module.



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



9) When any question or issue occurs, it shall be solved by mutual discussion.

10) This module is corresponded to RoHS.

### 14. Carton storage condition

Temperature 0°C to 40°C

Humidity 95%RH or less

Reference condition : 20°C to 35°C, 85%RH or less (summer)

: 5°C to 15°C, 85%RH or less (winter)

• the total storage time (40°C,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