HITACHI
Hitachi Displays, Ltd.

Date; Mar. 30, 2007

TECHNICAL DATA

TX38D88VC1GAB

CONTENTS

RECORD OF REVISION

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APPLICATIONS

This specification is applied to the following TFT Liquid Crystal Display Module with Back-light unit and LVDS (Low Voltage Differential Signaling) Interface.

Note: Inverter device for Back-light is not built in and so it needs to be prepared on your side.

Type name	: TX38D88VC1GAB
Display Area	: (H)304.1 × (V)228.1 [mm]
Display Pixels (Display Dots)	: (H)1,024 × (V)768 pixels (H(1024 × 3) × V768 [dots])
Power Supply Voltage	: 3.3 V
Pixel Pitch	: (H)0.297 × (V)0.297 [mm]
Color Pixel Arrangement	: R・G・B Vertical Stripe
Display Mode	: Transmissive & Normally White Mode
Color Number	: 262k Colors
Direction with Wider Viewing Angle	: Lower side of 6 o'clock (Azimuth ϕ = 270°)
Dimensions Outlines	: (W)315.8 × (H)241.5 typ. × (t)9.7max [mm]
Weight	: 800typ. [g]
Interface	: 1ch-LVDS
Surface Polarizing Film	: Glare Polarizing Film with Antireflection Coating.
Back-light	: Two Cold Cathode Fluorescent Lamp (Lower side) Back-light inverter is not contained in Module.

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Unit	Note
	Min.	Max.	Min.	Max.		
Ambient Temperature	0	40	-30	65	°C	1)
Humidity	40°C-95%RH		50°C-90%RH		%RH	1),2)
Vibration	–	14.7 (1.5G)	–	29.4 (3G)	m/s^2	3), 5)
Shock	–	29.4 (3G)	–	980 (100G)	m/s^2	4), 5)
Corrosive Gas	Not Acceptable		Not Acceptable		–	
Illumination at LCD Surface	–	50,000	–	50,000	lx	

Notes 1) Environmental temperature and humidity of this unit, not of system installed with this unit.
At low temperature the brightness of CFL drop and the life time of CFL become to be short.
2) Without condensation.
3) 10~500Hz,(Except resonance frequency),20minutes/cycle,1cycle,X-Y-Z
4) 3ms,X-Y-Z-Z'
5) With mounting protective spacer (ref. page 4-2/2)

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT Liquid Crystal Display Module Vss=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	0	4.0	V	
Electrostatic Durability	V_{ESD0}	±250		V	1)
	V_{ESD1}	±15		kV	2), 3)

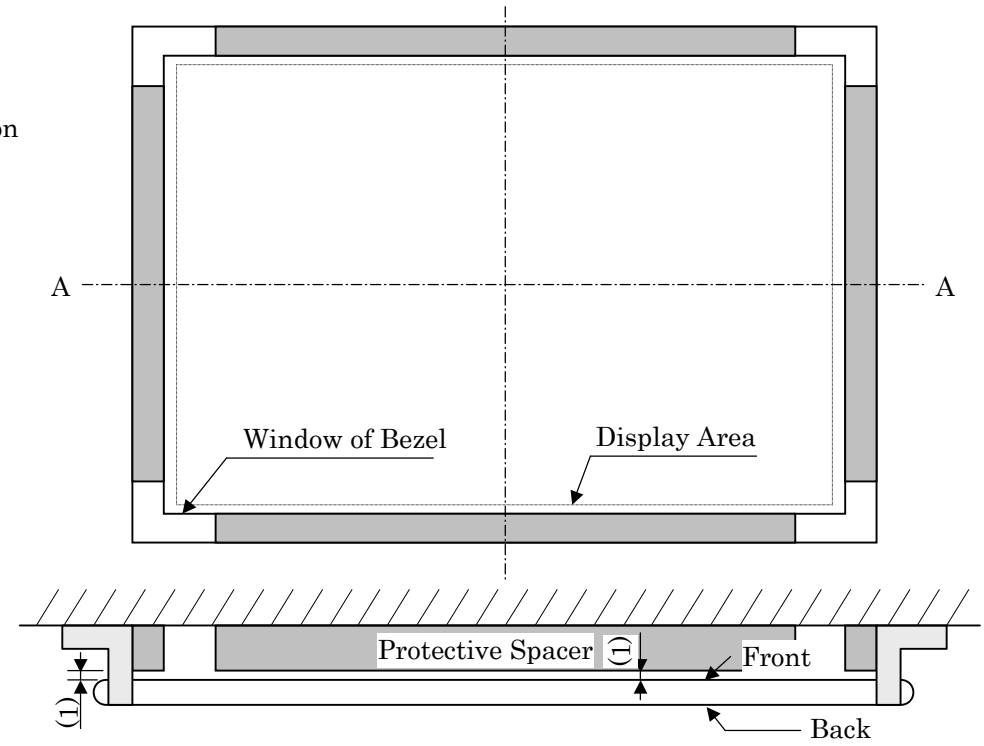
Notes 1) Electric discharge constant 200pF-0Ω,25°C-70%RH.
I/F Connector Pins are subjected.
2) Electric discharge constant 200pF-250Ω,25°C-70%RH.
3) The Surface of Metal bezel and LCD are subjected.

(2) Back Light unit GND=0V

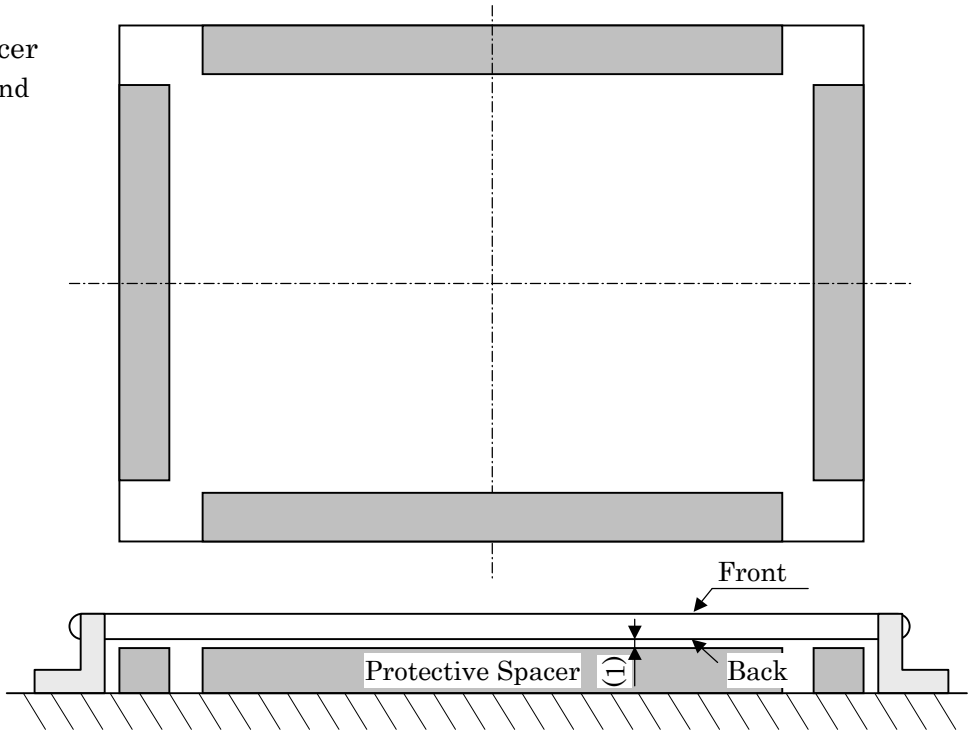
ITEM	Symbol	Min.	Max.	Unit
Lamp Current	I_L	0	7.0	mArms
Lamp Voltage	V_L	0	2,000	Vrms

Adding protective spacer at shock & vibration test

(1) This protective spacer is to be added at shock and vibration test on the front side



(2) This protective spacer is to be added shock and vibration test on the back side



2. OPTICAL CHARACTERISTICS

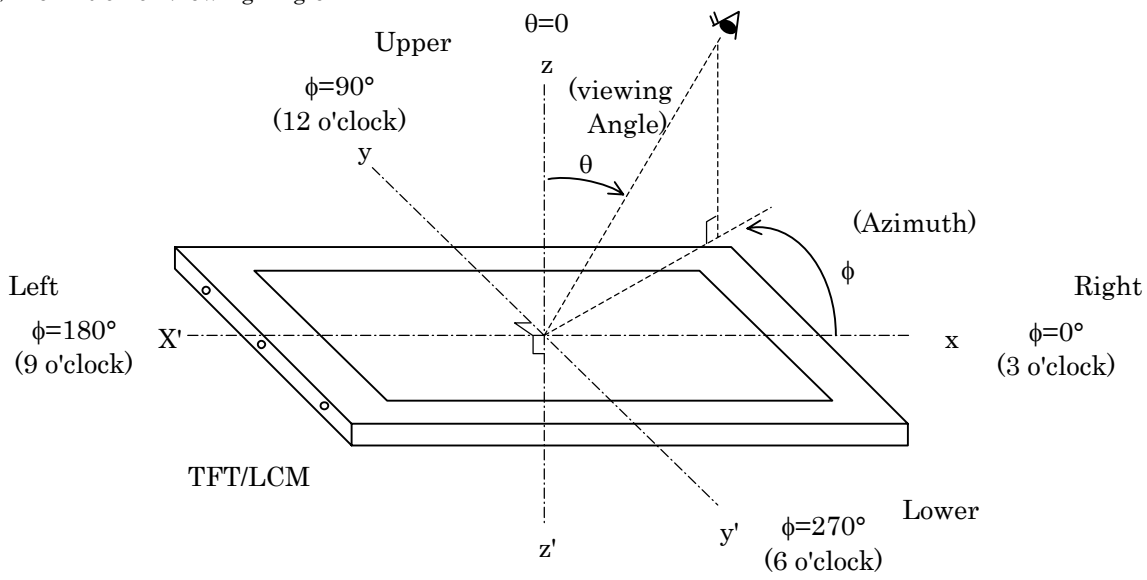
The following items are measured on the conditions that this unit operation (TFT panel and Back-light) and measuring systems are stable. (more than 30minites' operation)
The ambient light excluding The Back-light unit is nothing.

- Measuring equipment : TOPCON BM-7, Prichard 1980B, or equivalent
- Measuring point : Active area center

Temperature of LCD=25°C, V_{DD}=3.3V, f_V=60Hz, I_L=6mA,
Back-Light operation Frequency=50kHz

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ=0° Note 1)	–	600	–	–	2)
Response Time	Rise	tr		–	30	–	ms	3)
	Fall	tf		–	20	–		
Brightness (white)		Bwh		–	430	–	cd/m^2	
Color of CIE	Red	x		–	0.610	–	–	
		y		–	0.330	–		
	Green	x		–	0.320	–		
		y		–	0.550	–		
	Blue	x		–	0.150	–		
		y		–	0.120	–		
	White	x		–	0.320	–		
		y		–	0.330	–		
Viewing Angle of Area (CR≥10)	x-x'	θx	ϕ = 0°	–	80	–	deg.	1)
		θx'	ϕ = 180°	–	80	–		
	y-y'	θy	ϕ = 90°	–	50	–		
		θy'	ϕ = 270°	–	60	–		

Notes 1) Definition of Viewing Angle



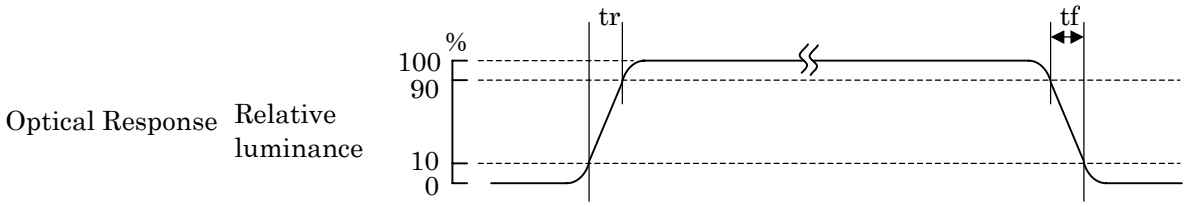
2) Definition of Contrast Ratio (CR)

$$CR = \frac{\text{Brightness when displaying White raster}}{\text{Brightness when displaying Black raster}}$$

These Brightness is measured on the center of screen.

* Measurement in the darkroom.

3) Definition of Response Time



3. ELECTRICAL CHARACTERISTICS

3.1 TFT LIQUID CRYSTAL DISPLAY MODULE

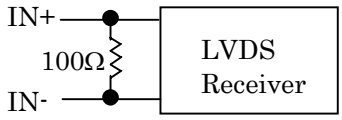
Ta=25°C, Vss=0V

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	Hi	V_{IH}	–	–	+100	mV	1)
	Lo	V_{IL}	-100	–	–		
Power Supply Current		I_{DD}	–	350	600	mA	2), 3)
Vsync Frequency		f_V	–	60	65	Hz	4), 5)
Hsync Frequency		f_H	–	48.5	52.4	kHz	4)
DCLK Frequency		f_{CLK}	–	65	67	MHz	4)

Notes 1) VCM=+1.25V ~ +1.375V

VCM is common mode voltage of LVDS transmitter/receiver.

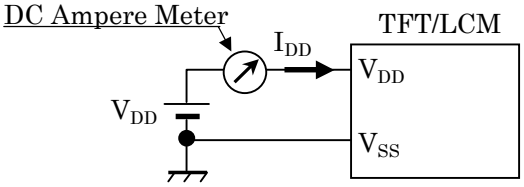
The input terminal of LVDS transmitter is terminated with 100Ω



2) fv=60Hz, f_{CLK}=65MHz, V_{DD}=3.3V, DC Current.

Typical value is measured when displaying vertical 64 gray scale.

Maximum is measured when displaying Vertical-stripe (Black-Gray 7).



3) As this module contains 0.8A fuse, prepare current source that is enough for cutting current fuse when a truble happens. (larger than 2A)

4) For LVDS Transmitter Input

5) Vsync Frequency (fH) (Recommendation) : 60Hz

Flicker level sill be worse by shift of V-Sync Frequency.

3.2 BACK-LIGHT UNIT

Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	2.8	5.0	6.5	mArms	1), 2)
		–	–	10	mA0-peak	
Lamp Voltage	V_L	–	710	–	Vrms	7)
Frequency	f_L	40	–	70	kHz	3)
Starting Lamp Voltage	Vs	1100	–	–	Vrms	4)
		1400	–	–		4), 5)

Notes 1) IL is Current of GND side.

2) Higher IL cause the short life time of CFL.

3) Lamp frequency may produce interference with Hsync frequency, causing beat or flicker on the display.

4) Starting Lamp Voltage is specified to the output of inverter with ballast capacitance > 22pF.

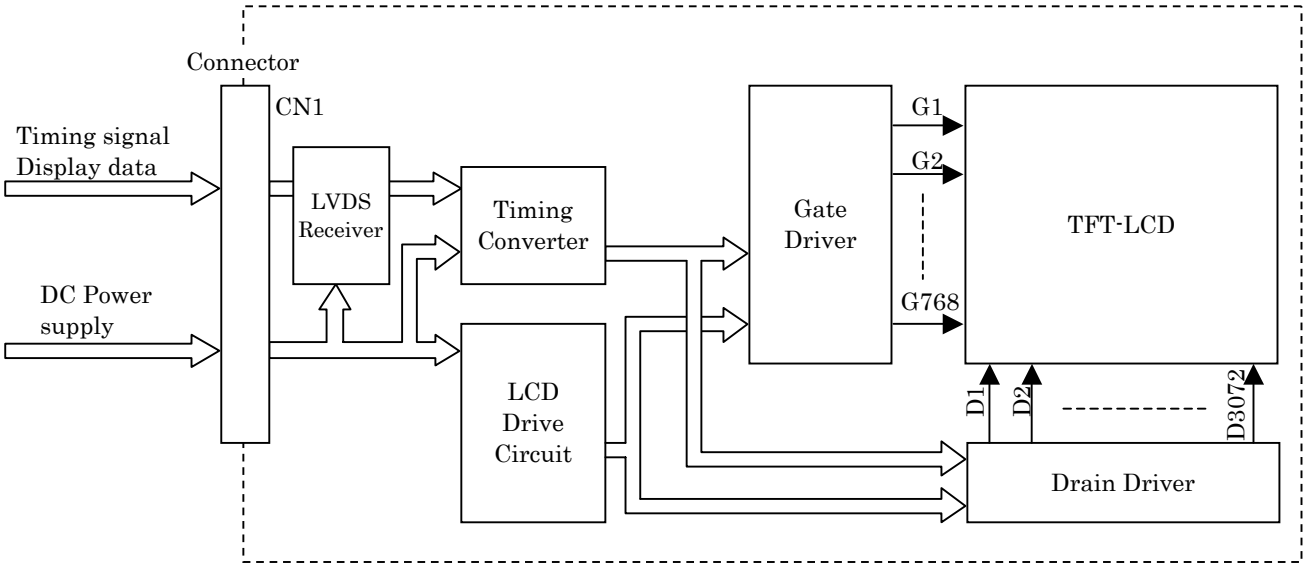
5) Ta=0°C

6) CFL life Time is the period that the brightness is half as the initial.

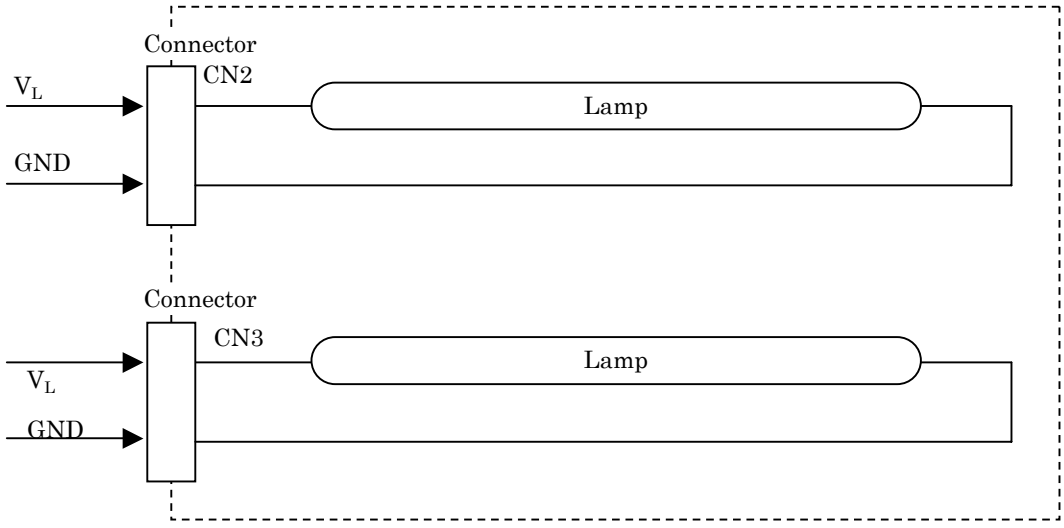
7) IL=5.0mA

4. BLOCK DIAGRAM

4.1 TFT LIQUID CRYSTAL DISPLAY MODULE



4.2 BACK-LIGHT UNIT



5. INTERFACE PIN CONNECTION

5.1 TFT LIQUID CRYSTAL DISPLAY MODULE

CN1 <<JAE FI-XB30SL-HF10 or Compatible>>

Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Power Supply 3.3V (typical)
3		
4	VSS	Ground
5	VSS	Ground
6	VSS	Ground
7	VSS	Ground
8	REin0-	LVDS Receiver Signal (-)
9	REin0+	LVDS Receiver Signal (+)
10	VSS	Ground
11	REin1-	LVDS Receiver Signal (-)
12	REin1+	LVDS Receiver Signal (+)
13	VSS	Ground
14	REin2-	LVDS Receiver Signal (-)
15	REin2+	LVDS Receiver Signal (+)
16	VSS	Ground
17	CLKE-	LVDS Clock Signal(-)
18	CLKE+	LVDS Clock Signal(+)
19	VSS	Ground
20	ROin0-	NC
21	ROin0+	NC
22	VSS	Ground
23	ROin1-	NC
24	ROin1+	NC
25	VSS	Ground
26	ROin2-	NC
27	ROin2+	NC
28	VSS	Ground
29	CLKO-	NC
30	CLKO+	NC

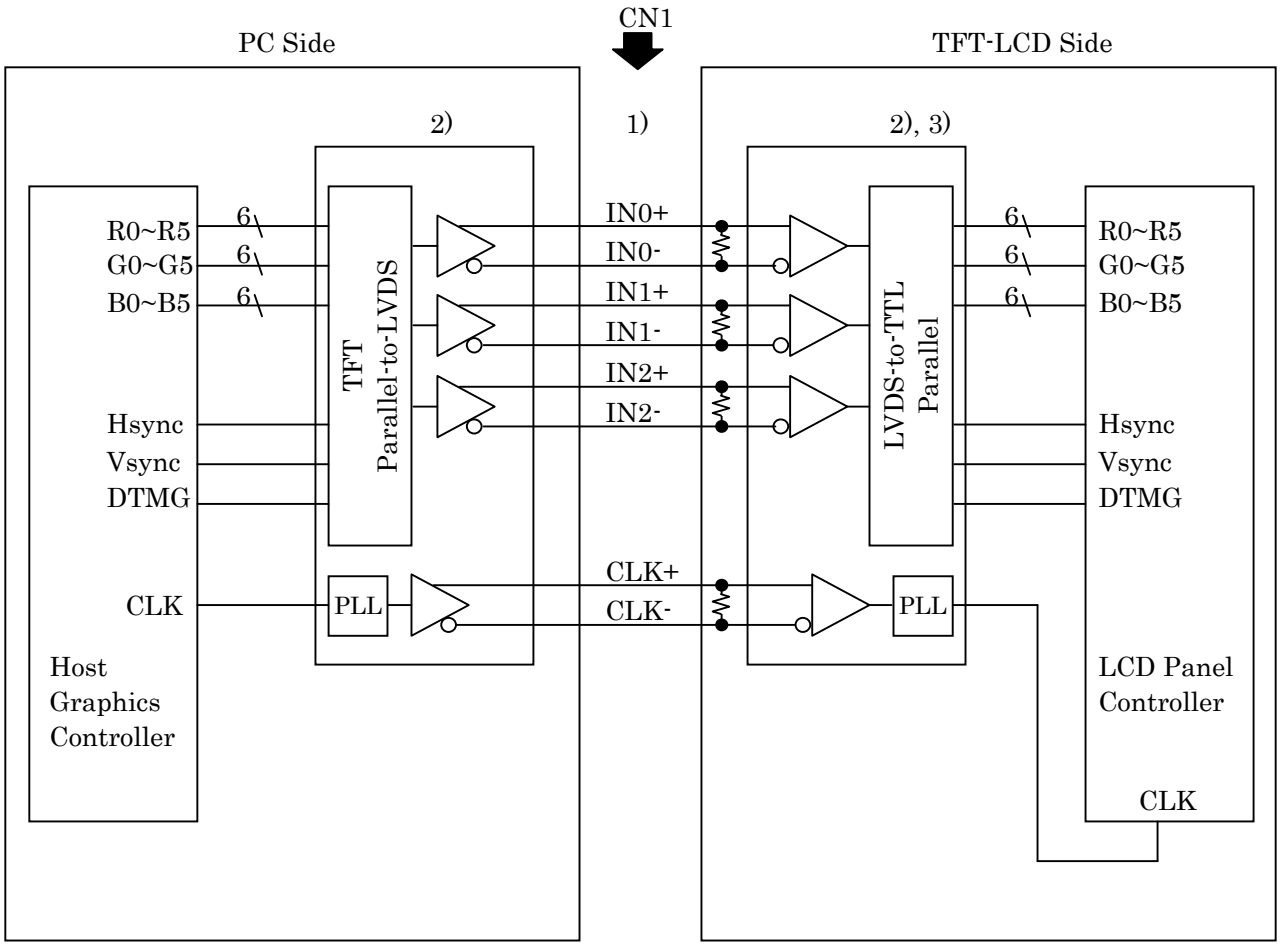
Notes 1) All VSS pins should be connected to GND (0V).
Metal bezel is connected internally to VSS.
2) All VDD pins should be connected to +3.3V.

5.2 BACK-LIGHT UNIT

CN2 <<JST BHSR-02VS-1>>

Pin No.	Symbol	Function
1	VL	Power Supply
2	GND	GND (0V)

LVDS INTERFACE

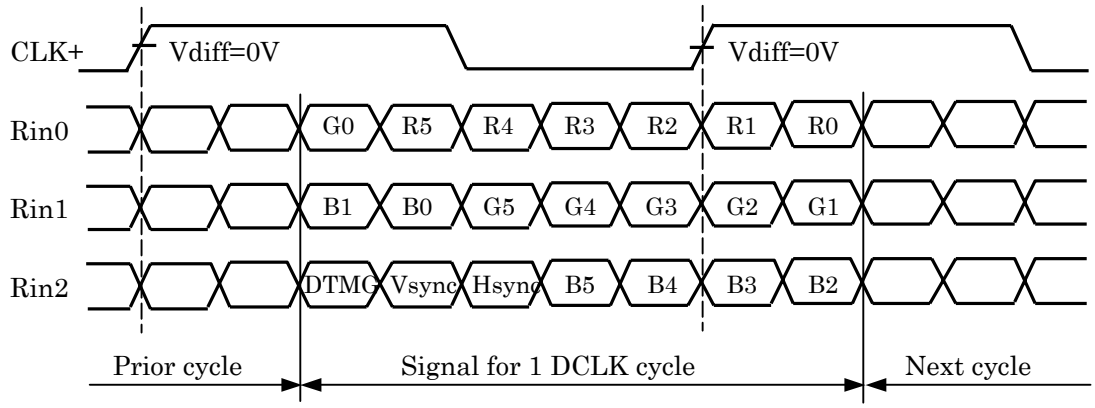


Notes 1) LVDS cable impedance is 100 ohms per signal line when each 2-lines(+,-) is used in differential mode.

2) LVDS transmitter is using LVDS input signal (page 8-3/4).

3) LVDS Receiver is THine THC63LVDM63A or compatible.

LVDS Input Signal



Pin connection in case of using
Thine THC63LVDM63A

INPUT SIGNAL	Transmitter
DCLK	CLK IN(26)
R0	IN0(44)
R1	IN1(45)
R2	IN2(47)
R3	IN3(48)
R4	IN4(1)
R5	IN5(3)
G0	IN6(4)
G1	IN7(6)
G2	IN8(7)
G3	IN9(9)
G4	IN10(10)
G5	IN11(12)
B0	IN12(13)
B1	IN13(15)
B2	IN14(16)
B3	IN15(18)
B4	IN16(19)
B5	IN17(20)
Hsync	IN18(22)
Vsync	IN19(23)
DTMG	IN20(25)

Note 1) ( ) indicate pin NO (IC).

RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT DATA

Color \ Input data		R Data						G Data						B Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Red (61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Green (61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Blue (61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Notes 1) Definition of gray scale :

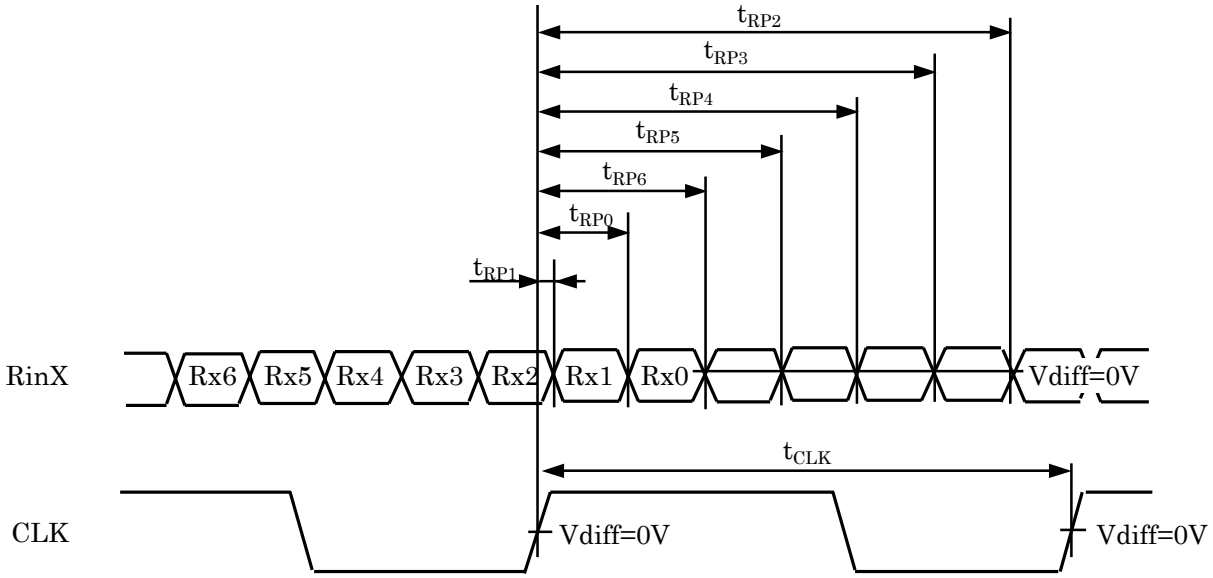
Color (n) --- number in parenthesis indicates gray scale level.

Larger number corresponds to brighter level.

2) Data Signal : 1: High, 0: Low

6. INTERFACE TIMING

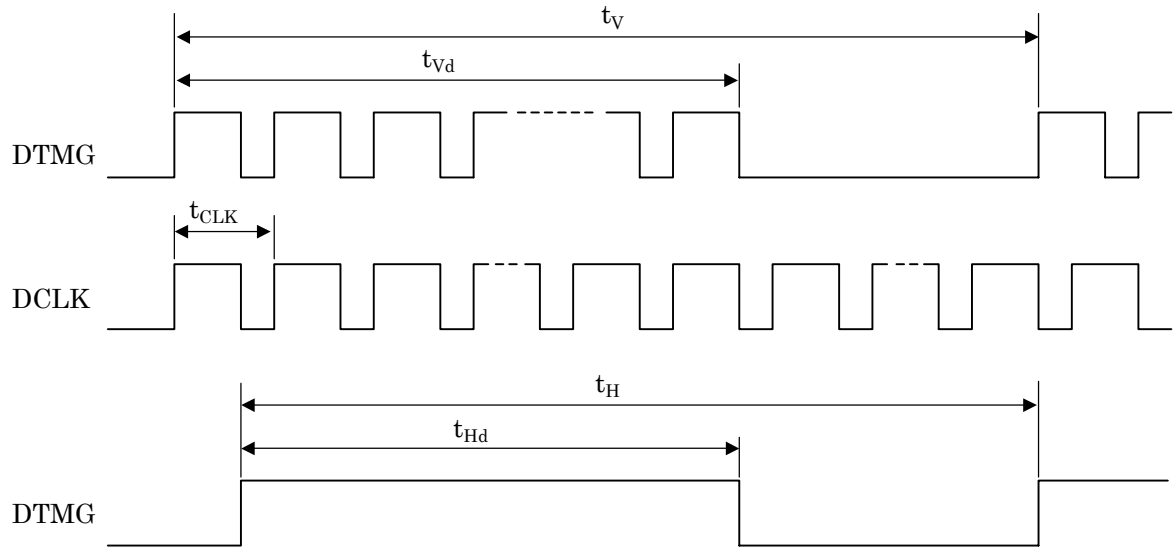
6.1 LVDS RECEIVER TIMING
(Interface of TFT module)



RinX=(RinX+)–(RinX-) (X=0,1,2)

Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	FREQUENCY	$1/t_{CLK}$	60	65	68	MHz	
RinX (X=0,1,2)	0 data position	t_{PR0}	$1/7t_{CLK}$–0.49	$1/7t_{CLK}$	$1/7t_{CLK}$+0.49	ns	
	1st data position	t_{PR1}	-0.49	0	+0.49		
	2nd data position	t_{PR2}	$6/7t_{CLK}$–0.49	$6/7t_{CLK}$	$6/7t_{CLK}$+0.49		
	3rd data position	t_{PR3}	$5/7t_{CLK}$–0.49	$5/7t_{CLK}$	$5/7t_{CLK}$+0.49		
	4th data position	t_{PR4}	$4/7t_{CLK}$–0.49	$4/7t_{CLK}$	$4/7t_{CLK}$+0.49		
	5th data position	t_{PR5}	$3/7t_{CLK}$–0.49	$3/7t_{CLK}$	$3/7t_{CLK}$+0.49		
	6th data position	t_{PR6}	$2/7t_{CLK}$–0.49	$2/7t_{CLK}$	$2/7t_{CLK}$+0.49		

6.2 TIMING CONVERTER TIMING
(Input timing for transmitter)

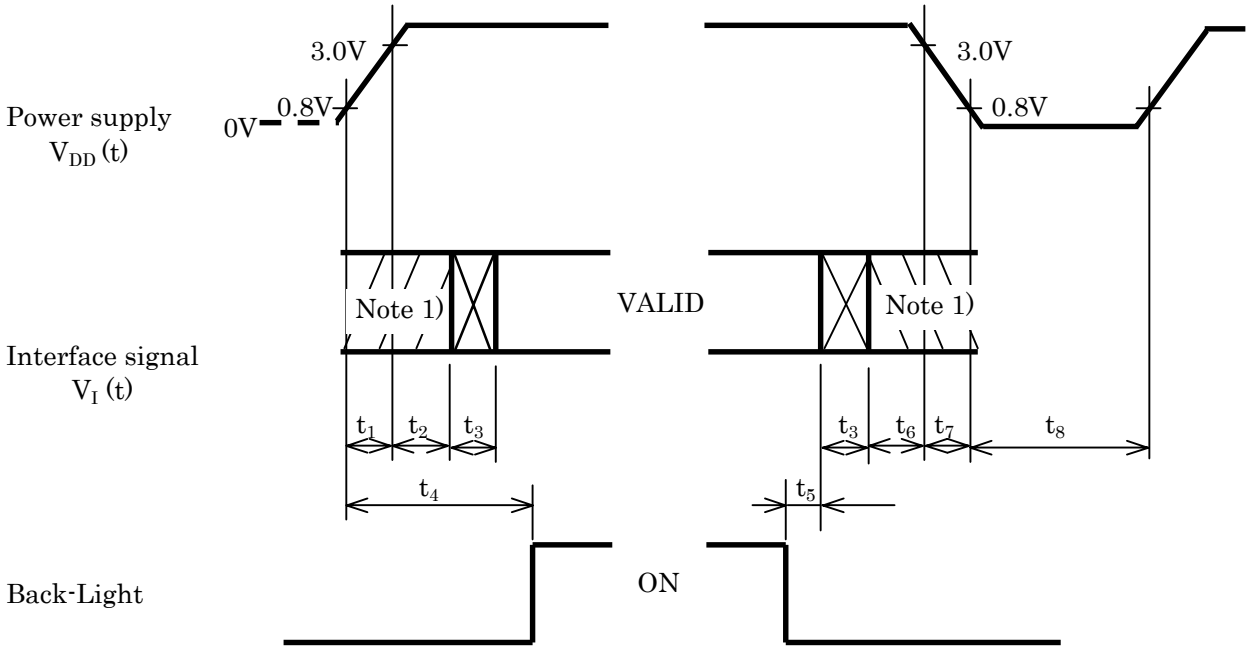


The timings except mentioned above are referred to the specifications of your transmitter.

Item		Symbol	Min.	Typ.	Max.	Unit
DCLK	Clock Frequency	1/Tc	35	65	68	MHz
DTMG	Line cycle time	t_H	1,160	1,344	1,644	t_{CLK}
	Line width-Active	t_{Hd}	1,024	1,024	1,024	
	Frame cycle time 1)	t_V	771	806	856	l_{ine}
	V width-Active	t_{Vd}	768	768	768	

Note 1) It counts by a typical value of line cycle time.

6.3 TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY



POWER ON		POWER OFF
$t_1 \leq 15ms$		$5ms \leq t_5$
$0 < t_2 \leq 45ms$		$0 \leq t_6 \leq 45ms$
$0 < t_3 \leq 5ms$		$0 \leq t_7 \leq 20ms$
$0.1s \leq t_4$	Note 3)	$0.4s \leq t_8$

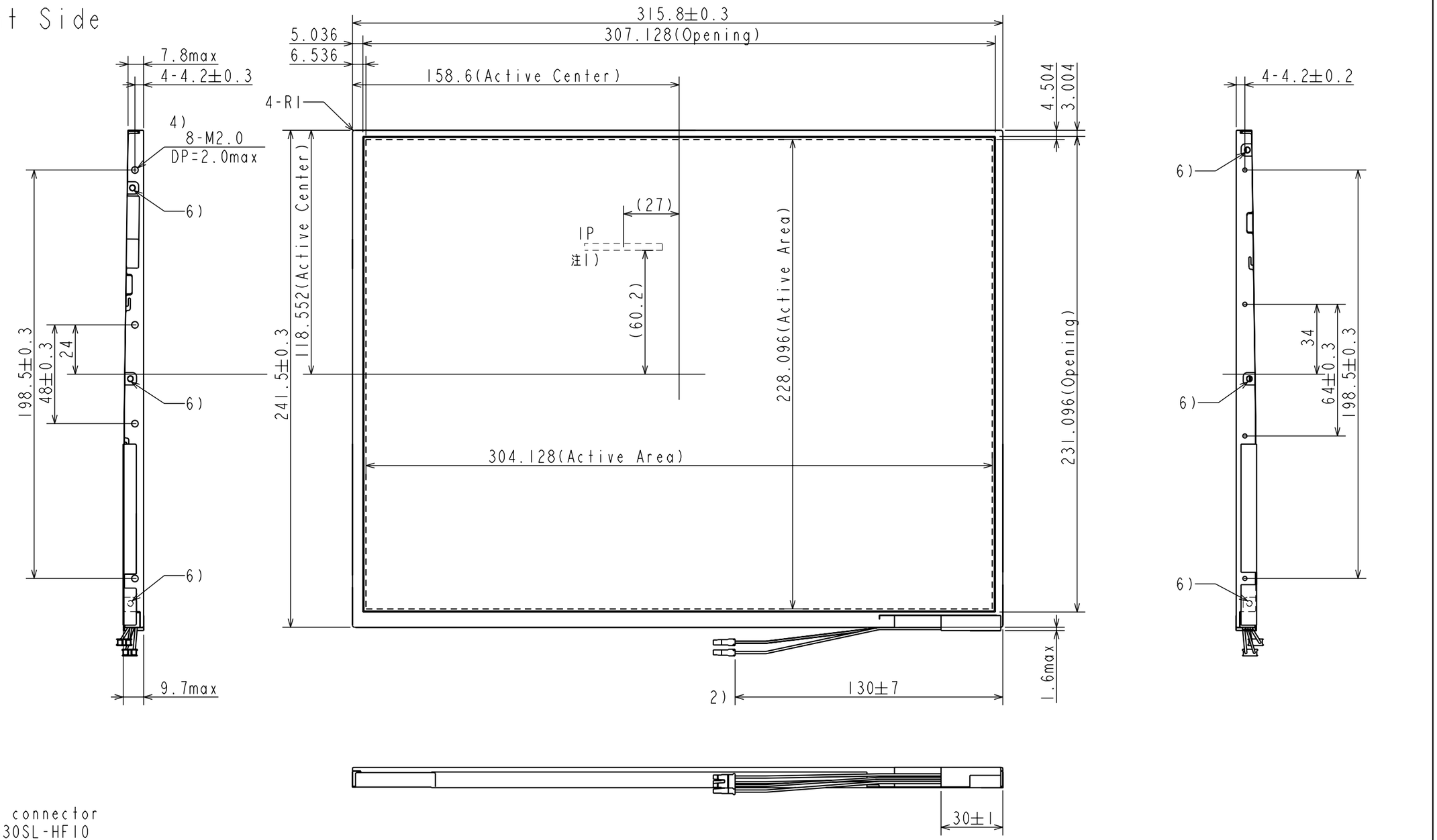
Notes 1) t2:Hi-Z(Hi-impedace)state

2) t3:Signal transition time from Hi-Z state to Valid state spesified by 3(1),6(1)and(2).

3) Recommended value

7. DIMENSIONAL OUTLINE

Front Side



1)Interface connector
  JAE:FI-XB30SL-HF10
2)CFL cable connector
  JST:BHSR-02VS-1
  Panel side connector pin : Hot cable(Pink)
  Back side connector pin : Hot cable(Blue)
3)The unspecified tolerance : ±0.5mm
4)Hole in mounting panel : 8holes
5)Maximum torgue for the screw in mounting panel : 0.196N·m(2.0kgf·cm)
6)Attachment screw : Total 6pcs

UNIT :mm
SCALE:NTS

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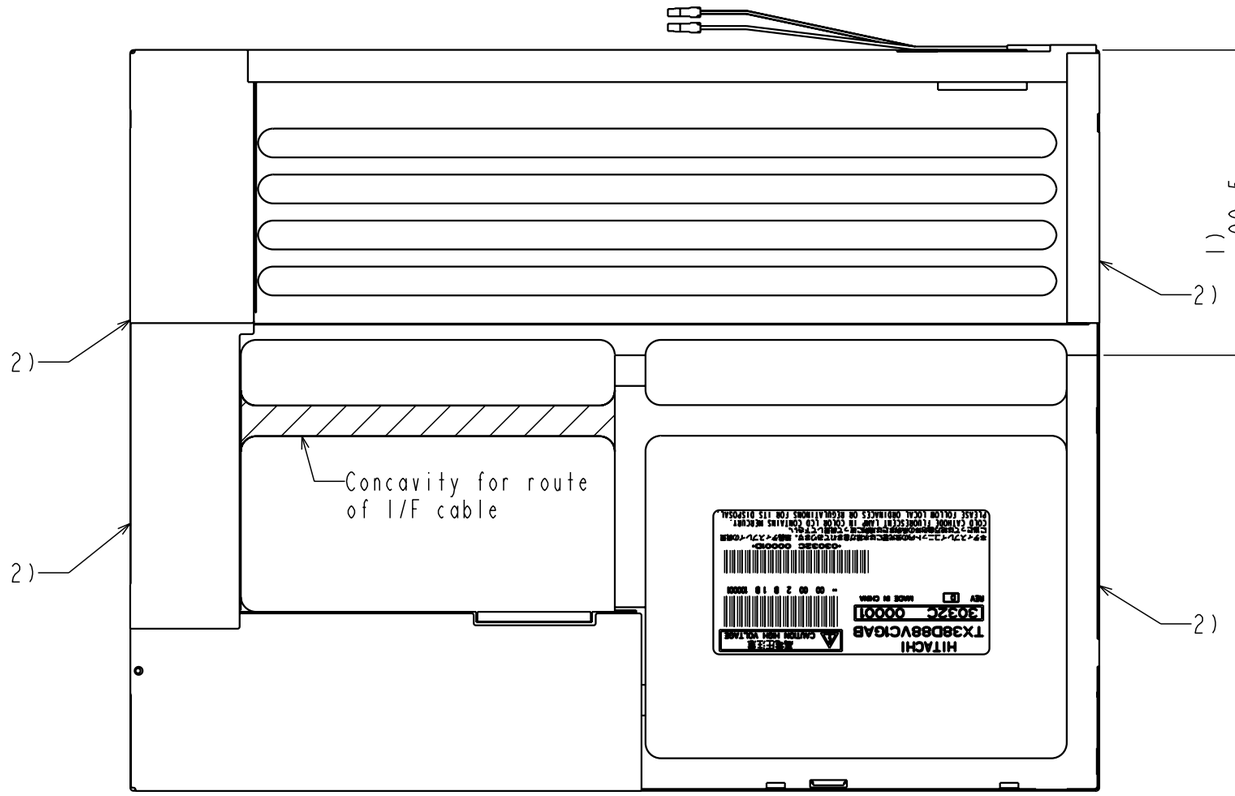
Back Side



1)Starting point of the slant on the module back side.
2)4frame nails aren't bent(up and bottom nails is bent)

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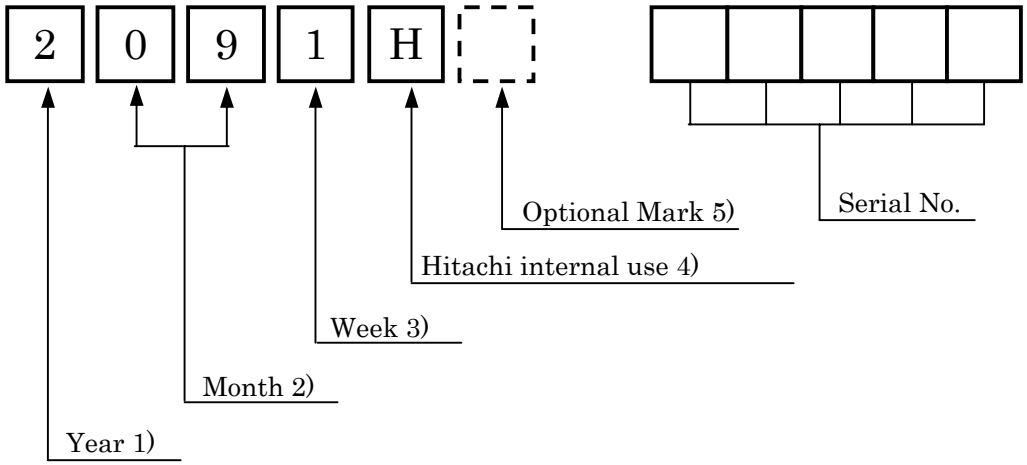
8. DESIGNATION OF LOT MARK

8.1 LOT MARK

Lot Mark is consisted of 4 digits for production lot and 7 digits for production control.



Notes

1)

Year	Mark
2006	6
2007	7
2008	8
2009	9
2010	0

2)

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

3)

Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

4)

H	Made in JAPAN
C	Made in CHINA

5) Optional Mark for Hitachi.

8.2 SERIAL NO.

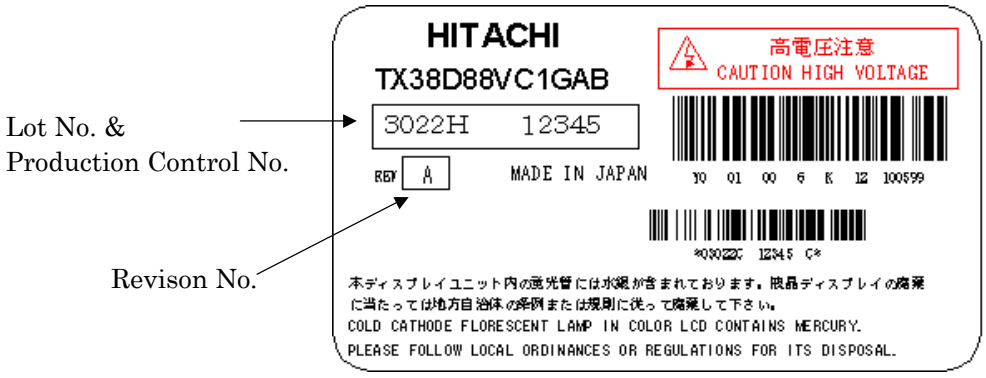
Serial No. is consisted of 5 digits number (00001~99999).

8.3 LOCATION OF LOT MARK

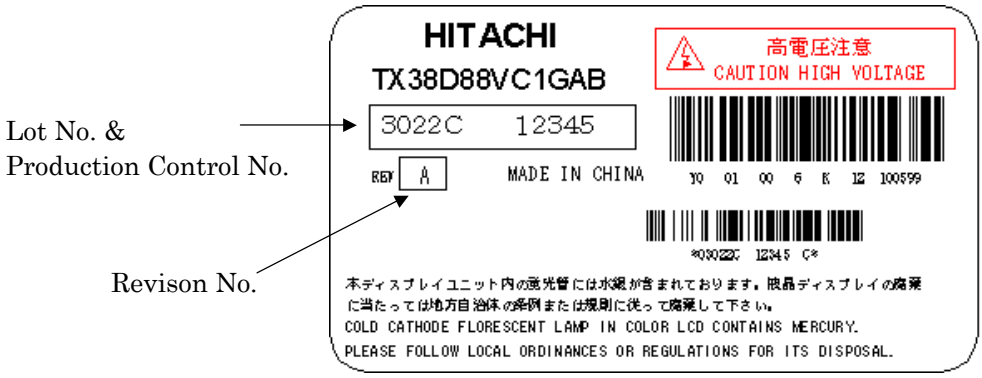
Label is attached on the back side of module.

8.4 REV.

8.4.1 Made in JAPAN



8.4.2 Made in CHINA



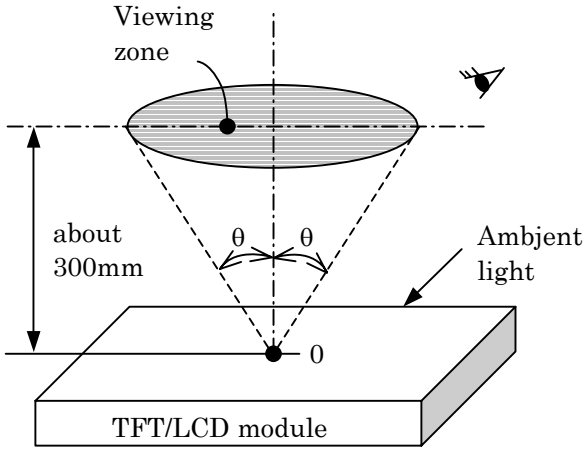
9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

i) The figure shows the correspondence between eyes (of inspector) and TFT/LCD module.
   - θ ≤ 45° when non-operating inspection
   - θ ≤ 5° when operating inspection

ii) Inspection should be executed only from front side, and only A-zone. Cosmetic of B-zone and C-zone are ignored. (refer to 9.2 DEFINITION OF ZONE)

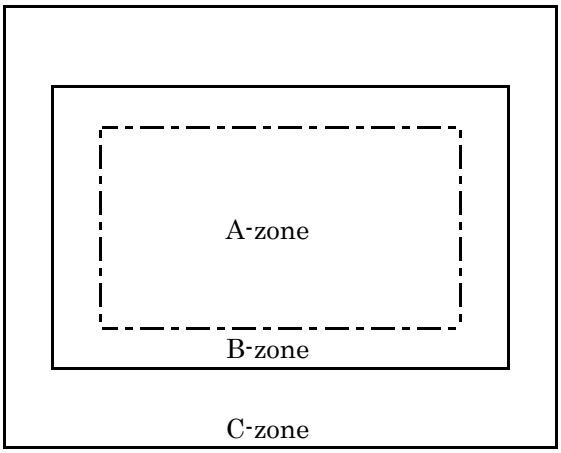


(2) Environmental

i) Temperature : 25°C
   When operating inspection, surface temperature of LCD panel is 25°C.
ii) Ambient light : More than 800 [lx] and non-directive.
iii) Back-light : When non-operating inspection, Back-light should be off.

(3) Operating inspection
Operating inspection should be done with 8 color mode (without gray scale).

9.2 DEFINITION OF ZONE



- A-zone : Display area (pixel area).
- B-zone : Area between A-zone and C-zone.
- C-zone : Metal bezel area. (Include I/F connector)

9.3 COSMETIC SPECIFICATIONS

When displaying condition is not stable (ex. at turn on or off), the following specifications are not applied.

No.	Item				Maximum acceptable number		Note
					A-zone	Unit	
1	Dot Defect	Sparkle mode	1dot		10	pcs	1), 2) 4)
			2dots		3	units	1), 2), 5)
			3dots		0		
			density		1	pcs/ϕ15	1), 2), 6)
		Black mode	1dot		10	pcs	1), 3), 4)
			2dots		4	units	1), 3), 5)
			3dots		0		
			density		1	pcs/ϕ5	1), 3), 6)
		Total			10	pcs	1)
2	Line Defect				Serious one is no good.	–	–
3	Uneven Brightness						
4	Stain Inclusion (Line shape W: width (mm) L: length (mm))		W < 0.05	L:Ignore	Ignore	pcs	7)
			W ≥ 0.05 < 0.08	L ≤ 2.0	10		
			0.08 ≤ W	–	By Dot shape		
5	Stain Inclusion (Dot shape D: average dia.(mm))		D < 0.22		Ignore	pcs	7)
			0.22 ≤ D < 0.45		5		
			0.45 ≤ D		0		
6	Scratch on polarizer (Line shape W: width (mm) L: length (mm))		W < 0.01	L: Ignore	Ignore	pcs	8)
			W ≤ 0.02	L ≤ 40	10		
				L > 40	0		
			W ≤ 0.04	L ≤ 20	10		
				L > 20	0		
7	Polarizer Dent/Bubble /Peeling (D: average dia.(mm))		D ≤ 0.3		Ignore	pcs	8)
			0.3 < D ≤ 0.5		10		
			0.5< D ≤ 1.0		5		
			1.0 < D		0		
8	Wrinkles on Polarizer				Serious one is no good.	–	–

Notes 1) Dot Defect : Defect area > 1/2 dot

2) Sparkle mode : Brightness of dot is more than 30% at Black raster. (Visible to eye)

3) Black mode : Brightness of dot is less than 70% at white raster. (Visible to eye)

4) 1 dot : defect dot is isolated, not attached to other defect dot.

5) N dots : N defect dots are consecutive. (N means the number of defect dots. (N ≥ 2))

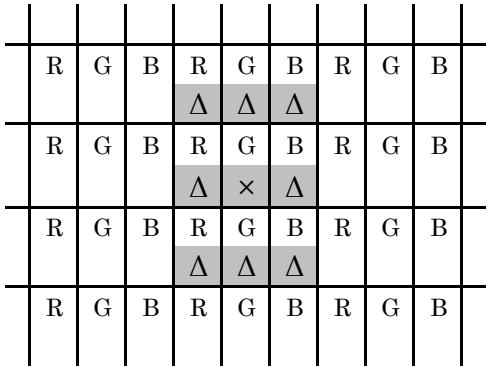


Fig. (a)

The combination of the defect dot × and other defects (Δ) as shown in Fig. (a) are considered as consecutive defect dots.

Δ : Directory adjacent to ×

6) Density : Number of defect dots inside of specified diameter.

7) Those stains which can be wiped out easily are acceptable.

8) Polarizer area inside of B-zone is not applied.

10. PRECAUTIONS

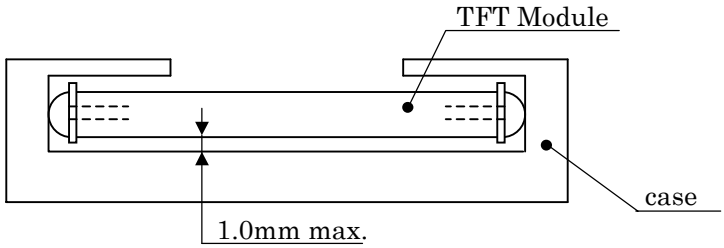
Please pay attention to the followings when you use this TFT/LCD module with Back-light unit.

10.1 MOUNTING PRECAUTION

(1) You must mount Module using mounting holes (8 holes at side of Module) tightly.

(2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to Module.
And the case which Module is mounted should have sufficient strength so that external force is not transmitted directly to Module.

(3) To improve the strength of module against the mechanical shock the space between module and the case should be less than 1.0mm.



(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case should not be used. Because the former generate corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub by dusty clothes with chemical treatment.
Do not touch the surface of polarizer with bare hand or greasy close.
(Some cosmetics are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton. IPA (Isopropyl Alcohol) is recommended for cleaning the adhesives used to attach front/rear polarizers. Don't use acetone, toluene, and alcohol because they cause chemical damage to polarizer

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits have not sufficient strength.

(10) Use fingerstalls of soft gloves in order to keep clean display quality, when you handle the device for incoming inspection and assembly.

(11) Do not pull or do not fold the CFL cable.

(12) Either the current “FI-X30H” or the “FI-X30HL”, which holds the lock mechanism manufactured by JAE, can also be used as a plug connector. However when pulling out the “FI-X30HL” type, pull out the plug connector while pushing release buttons to make the lock invalid.

10.2 OPERATING PRECAUTION

(1) Response time depends on the temperature. (In lower temperature, it becomes longer). And also Transmittance and Color depend on the temperature.
(2) Brightness depends on the temperature. (In lower temperature, it becomes lower). And in lower temperature, response time (required time that brightness is stable after turn on) becomes longer.
(3) Optical characteristics (eg. Luminance, uniformity, color coordinate etc.) gradually change by operating condition, especially low temperature change faster, because LCD module has Cold Cathode Fluorescent Lamp.
(4) Be careful for condensation at sudden temperature change. Condensation make damage to polarizer or electrical contact part. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed at long times, afterimage is likely to occur.
(6) The Module have high frequency circuit. If you need to shield the electromagnetic noise, please do in yours.
(7) When Back-light unit is operating, it sounds. If you need to shield the noise, please do in yours.
(8) Please connect the Back-light connector to the inverter circuit directly. The long cable between CFL and the inverter may cause the brightness drop of CFL and may cause the rise of starting lamp Voltage (VS).
(9) Do not connect or remove the module from main system with power applied.

10.3 ELECTROSTATIC DISCHARGE CONTROL

(1) Since Module is composed with electronic circuit, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through list band etc.. And don't touch I/F pin directly.
(2) When the polarizer protection film is peeled off, electrostatic discharge occurs. Please peel it of slowly.

10.4 PRECAUTION FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

10.5 STORAGE

When storing Module as spares for long time, the following precautions are necessary.

(1) Store them in a dark place ; do not expose then to sunlight or fluorescent light.
Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

10.6 HANDLING PRECAUTIONS FOR PROTECTIVE FILM

(1) When the protective film is peeled off, static electricity is generated between the film and the polarizer.
This film should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) The protective film is attached to the polarizer with a small amount of glue.
If some stress is applied to rub the protective film against the polarizer during the time you peel off the film, the glue is apt to remain more on the polarizer.
So please carefully peel off the protective film without rubbing it against the polarizer.
(3) When the Module with protective film attached is stored for long time, sometimes there remains a very small amount of glue, still on the polarizer after the protective film is peeled off.
Please refrain from storing the Module at the high temperature and high humidity for glue is apt to remain in these condition.
(4) The Glue may be taken for the Modules failure, but you can remove the Glue easily.
When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material soaked with IPA (Isopropyl Alcohol).

10.7 SAFETY

(1) If Module is broken, be careful to handle not to injure. (TFT/LCD and Lamp are made of glass.)
Please wash hands sufficiently when you touch the liquid crystal coming out from broken LCDs.

(2) As Back-light unit has high voltage circuit internal, do not open the case and do not insert foreign materials in the case.

(3) The LCD Modules include Cold Cathode Fluorescent Lamp (CFL).
CFL contains a small amount of mercury. Please follow local ordinances or regulations for disposal.

(4) The CFL inverter should be designed to include the function of output shutdown in case the output over current happens due to any backlight trouble.
The shutdown function should be assured to work in abnormal condition at the actual system.