

HITACHI

Hitachi Displays, Ltd.

Date; Jan. 25, 2008

TECHNICAL DATA

TX31D67VC1CAA

CONTENTS

No.	Item	Sheet No.	Page
—	COVER	DPBCL0001723-1	1-1/1
—	RECORD OF REVISION	DPBCL0001723-1	2-1/1
—	APPLICATIONS	DPBCL0001723-1	3-1/1
1	ABSOLUTE MAXIMUM RATINGS	DPBCL0001723-1	4-1/2 - 4-2/2
2	OPTICAL CHARACTERISTICS	DPBCL0001723-1	5-1/2 - 5-2/2
3	ELECTRICAL CHARACTERISTICS	DPBCL0001723-1	6-1/1
4	BLOCK DIAGRAM	DPBCL0001723-1	7-1/1
5	INTERFACE PIN CONNECTION	DPBCL0001723-1	8-1/4 - 8-4/4
6	INTERFACE TIMING	DPBCL0001723-1	9-1/3 - 9-3/3
7	DIMENSIONAL OUTLINE	DPBCL0001723-1	10-1/2 - 10-2/2
8	DESIGNATION OF LOT MARK	DPBCL0001723-1	11-1/2 - 11-2/2
9	COSMETIC SPECIFICATIONS	DPBCL0001723-1	12-1/3 - 12-3/3
10	PRECAUTIONS	DPBCL0001723-1	13-1/4 - 13-4/4

RECORD OF REVISION

Date	The upper section : Before revision The lower section : After revision		Summary
	Sheet No.	Page	

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	: TX31D67VC1CAA
Display Area	: (H)245.76 × (V)184.32 [mm]
Display Pixels (Display Dots)	: (H)1,024 × (V)768 pixels (H(1024 × 3) × V768 [dots])
Pixel Pitch	: (H)0.24 × (V)0.24 [mm]
Color Pixel Arrangement	: R•G•B Vertical Stripe
Display Mode	: Transmissive & Normally White Mode
Color Number	: 262k Colors
Front Side Polarizer	: Polarizer with Antiglare Coating.
Direction with Wider Viewing Angle	: Lower side of 6 o'clock (Azimuth $\phi = 270^\circ$)
Dimensions Outlines	: (W)263.0 typ. × (H)198.0 typ. × (t)7.1 max [mm]
Weight	: 400 (typ.) [g]
Interface	: 1ch-LVDS
Back-light	: One Cold Cathode Fluorescent Lamp

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Unit	Note
	Min.	Max.	Min.	Max.		
Ambient Temperature	5	45	-20	60	°C	1)
Humidity	2)		2)		%RH	1)
Vibration	-	4.9 (0.5G)	-	19.6 (2G)	m/s ²	3), 5)
Shock	-	29.4 (3G)	-	490 (50G)	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) Ambient temp. $T_a \leq 40^\circ\text{C}$: 85%RH MAX. without condensation.

$T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C. Without condensation.

3) Vibration frequency : 20~50Hz.

4) 7ms of pulse width.

5) With mounting protective spacer (ref. page 4-2/2)

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT Liquid Crystal Display Module

$V_{SS}=0V$

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	0	4.0	V	
Electrostatic Durability	V_{ESD0}	±100		V	1), 2)
	V_{ESD1}	±8		kV	1), 3)

Notes 1) Discharge circuit: 200pF-250Ω, Surrounding: 25°C-70%RH.

2) The I/F Connector pins are subjected.

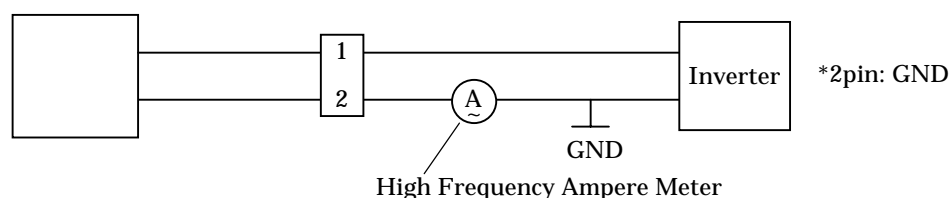
3) The Surface of Metal bezel and LCD are subjected.

(2) Back Light unit

$GND=0V$

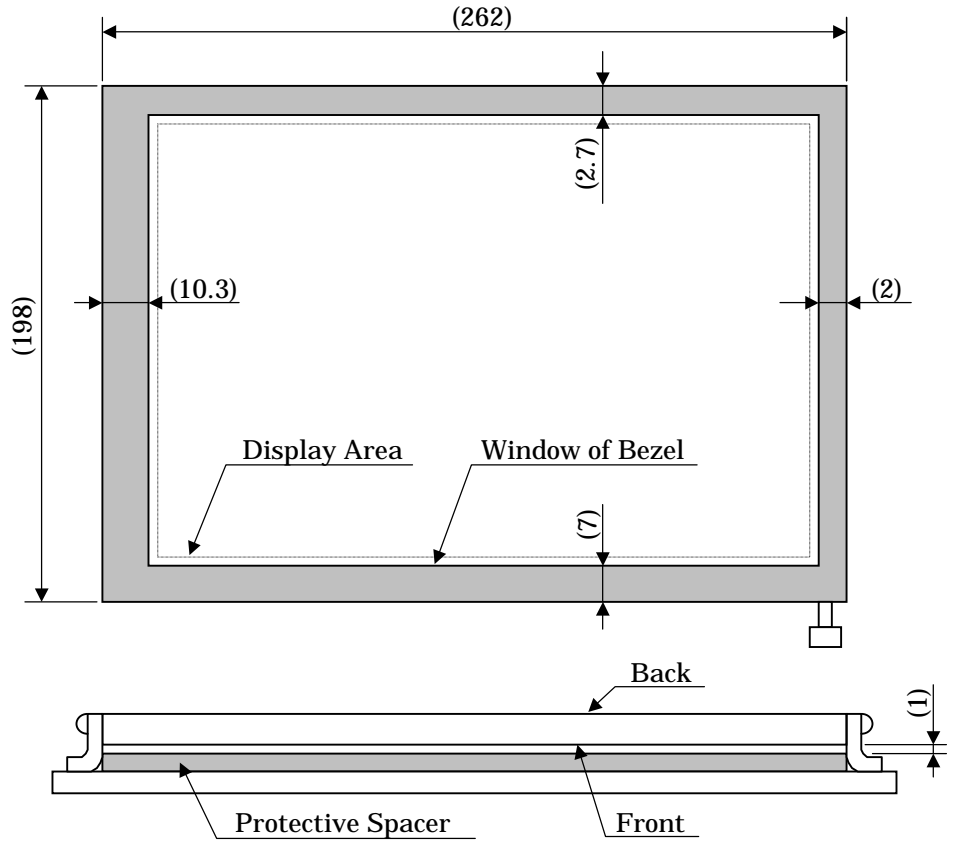
ITEM	Symbol	Min.	Max.	Unit	Note
Lamp Current	I_L	0	8.0	mArms	1)
Lamp Voltage	V_L	0	2,000	Vrms	

Note 1) TFT/LCM

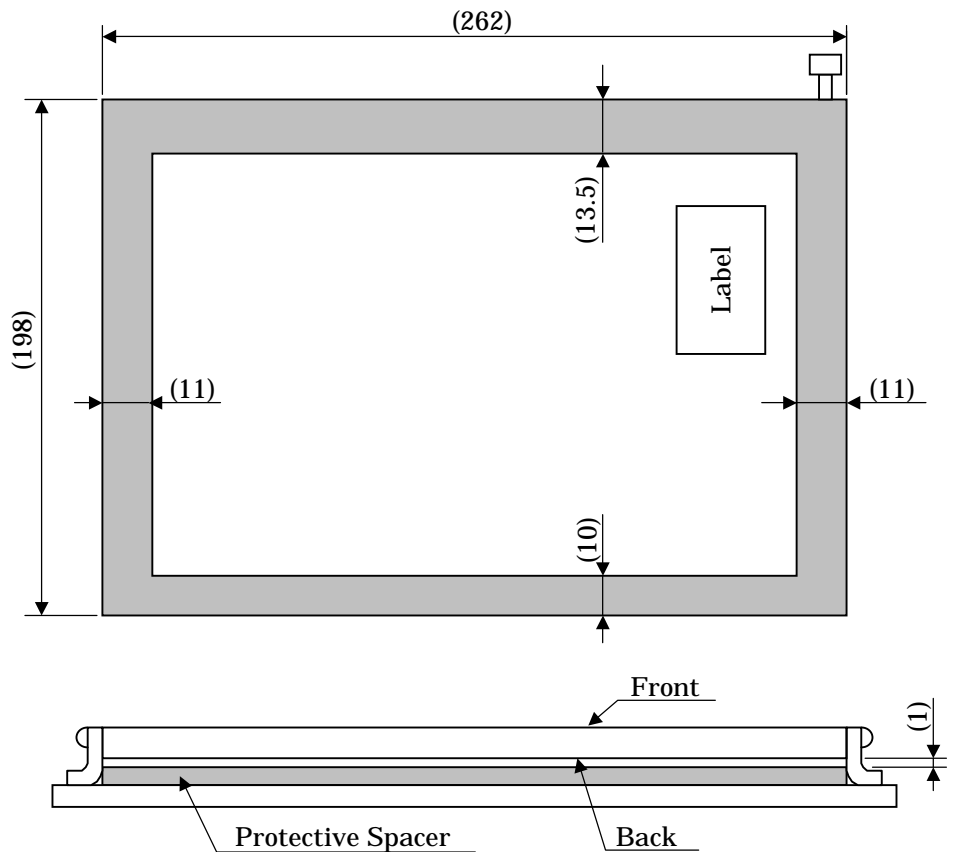


Protective spacer

(1) This protective spacer is applied to shock and vibration test toward front surface



(2) This protective spacer is applied to shock and vibration test toward back surface



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.

The ambient light excluding The Back-light unit is nothing.

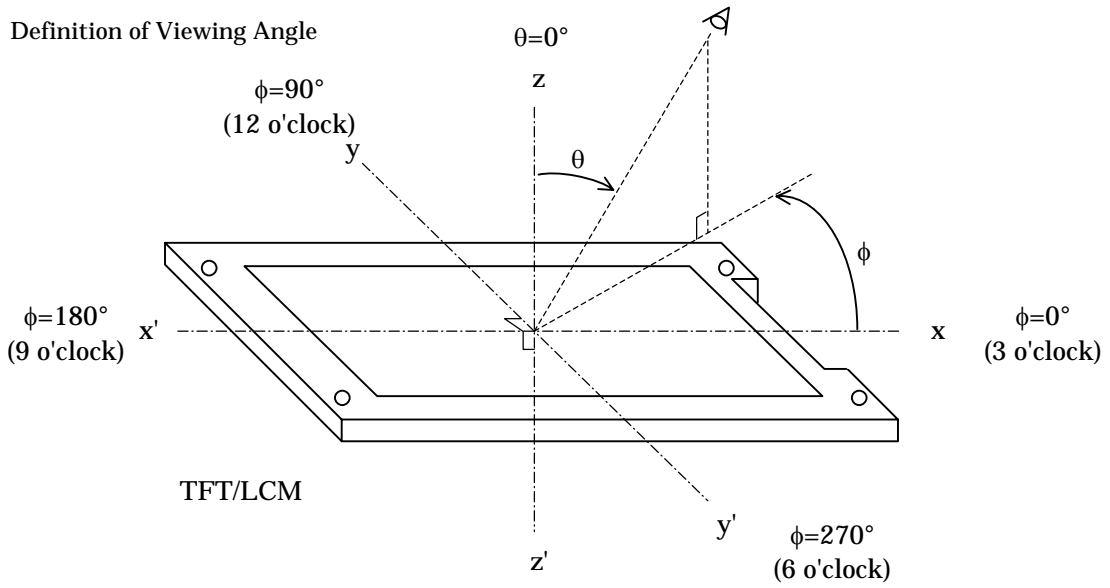
The measurement point is center of display area.

- Measuring equipment : TOPCON BM-7, Prichard 1980A, or equivalent

Temperature of LCD=25°C, $V_{DD}=3.3V$, $f_V=60Hz$, $I_L=4.5mA$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio	CR	$\theta=0^\circ$ Note 1)	100	150	–	–	2)	
Response Time	Rise		tf	–	40	90	ms	3)
	Fall		tf	–	20	60		
Brightness (white)	Bwh			70	100	–	cd/m ²	$I_L=4.5mA$
				100	130			$I_L=6.0mA$
Color of CIE	Red		x	0.54	0.57	0.60	–	
			y	0.29	0.32	0.35		
	Green		x	0.27	0.30	0.33		
			y	0.51	0.54	0.57		
	Blue		x	0.11	0.14	0.17		
			y	0.09	0.12	0.15		
	White	x	0.28	0.31	0.34			
		y	0.30	0.33	0.36			
Brightness Uniformity (white)	Bvar		–	–	40	%	4)	
Viewing Angle (CR≥10)	x-x'	θ_x	$\phi = 0^\circ$	35	–	–	deg.	1)
		$\theta_{x'}$	$\phi = 180^\circ$	35	–	–		
	y-y'	θ_y	$\phi = 90^\circ$	5	–	–		
		$\theta_{y'}$	$\phi = 270^\circ$	35	–	–		

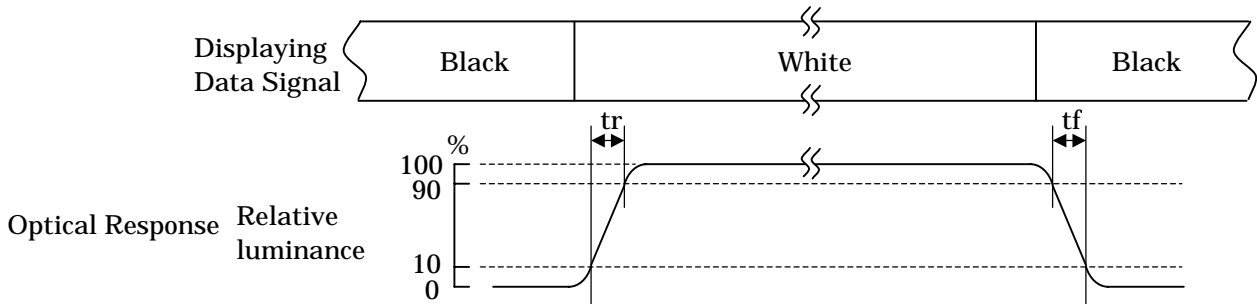
Notes 1) Definition of Viewing Angle



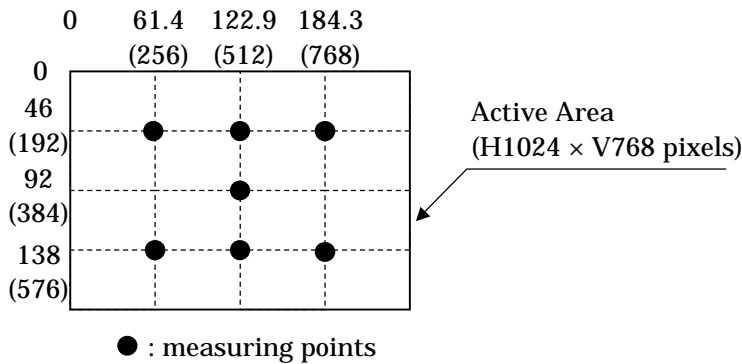
2) Definition of Contrast Ratio (CR)

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

3) Definition of Response Time



4) Definition of Brightness Uniformity. (White)



$$\text{Brightness Uniformity} = \left(\left(\frac{\text{The Brightness of the Brightness point}}{\text{The Brightness of the Darkest point}} \right) - 1 \right) \times 100$$

3. ELECTRICAL CHARACTERISTICS

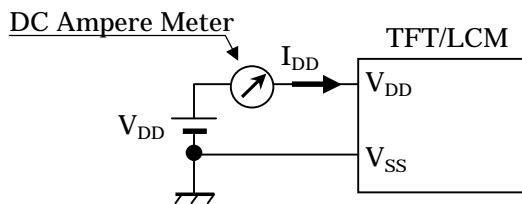
3.1 TFT LIQUID CRYSTAL DISPLAY MODULE

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}	-	370	560	mA	2),3)
Vsync Frequency	f _V	59	60	65	Hz	4)
Hsync Frequency	f _H	45.5	48.4	52.1	kHz	4)
DCLK Frequency	f _{CLK}	60	65	68	MHz	4)

Notes 1) VCM=+1.125 ~ +1.375V

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



Typical value is measured when displaying Black raster.

Maximum value is measured when displaying Vertical-stripe pattern.

- 3) As this module contains 1.0A current fuse, prepare current source that is enough for blowing current fuse when a trouble happens.
- 4) For LVDS Transmitter Input

3.2 BACK-LIGHT UNIT

Ta=25°C, GND=0V

ITEM	SYMBOL	Min.	Typ.	Max.	Unit	Note
Lamp Current	I _L	3.0	4.5	6.0	mArms	1), 4)
Lamp Voltage	V _L	540	605	670	Vrms	
Frequency	f _L	50	65	70	kHz	2)
Starting Lamp Voltage	V _s	1,100	-	-	Vrms	3)
		1,600	-	-		

Notes 1) Higher I_L cause the short life time of CFL.

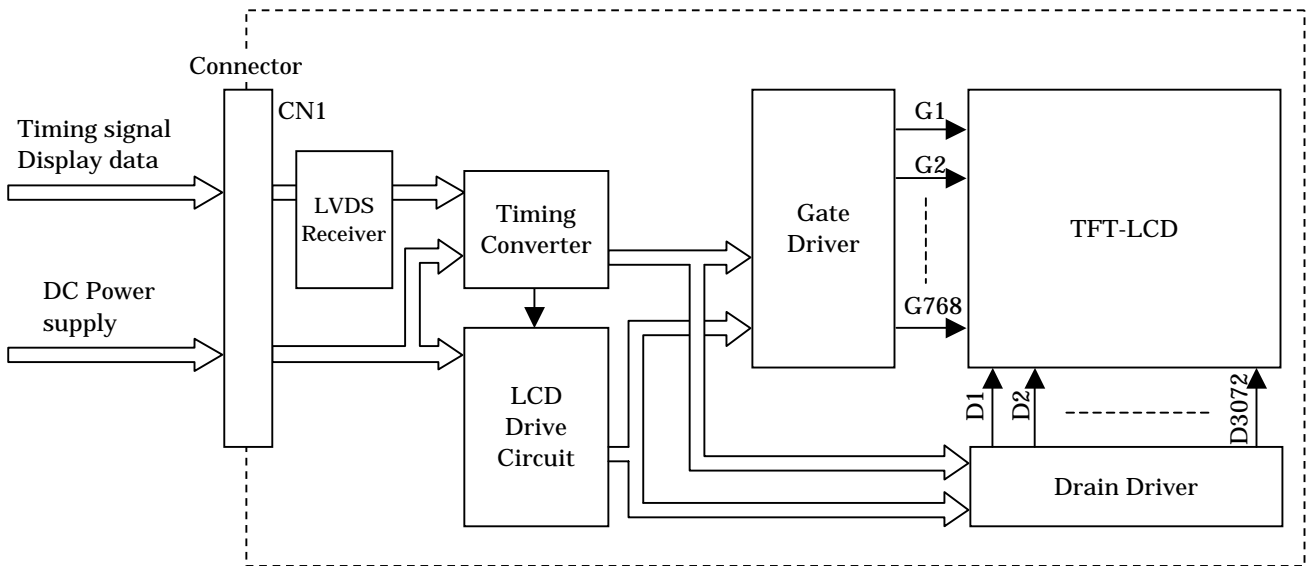
2) Lamp frequency may produce interference with Hsync frequency, causing beat or flicker on the display. Therefore lamp frequency shall be as different as possible from Hsync frequency, to avoid interference.

3) Ta = 5°C

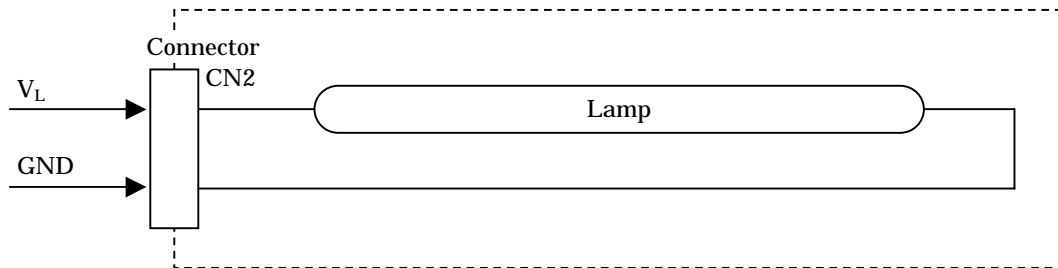
4) Ref. Page 4-1/2 (2) Back Light unit Note 1)

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-SEB20P-HF13 or equivalent>>

(Mating side connector: FI-SE20M or FI-S20S)

Pin No.	Symbol	Function	Note
1	V _{DD}	Power Supply 3.3V nominal	2)
2	V _{DD}	Power Supply 3.3V nominal	2)
3	V _{SS}	Ground	1)
4	V _{SS}	Ground	1)
5	Rin0-	Receiver Signal (-)	
6	Rin0+	Receiver Signal (+)	
7	V _{SS}	Ground	1)
8	Rin1-	Receiver Signal (-)	
9	Rin1+	Receiver Signal (+)	
10	V _{SS}	Ground	1)
11	Rin2-	Receiver Signal (-)	
12	Rin2+	Receiver Signal (+)	
13	V _{SS}	Ground	1)
14	CLK-	Clock Signal (-)	
15	CLK+	Clock Signal (+)	
16	V _{SS}	Ground	1)
17	NC	Reserved	3)
18	(IC)		3)
19	V _{SS}	Ground	1)
20	V _{SS}	Ground	1)

Notes 1) All V_{DD} pins should be connected to GND (0V.).

Metal bezel is connected internally to V_{SS}.

2) All V_{DD} pins should be connected to +3.3V.

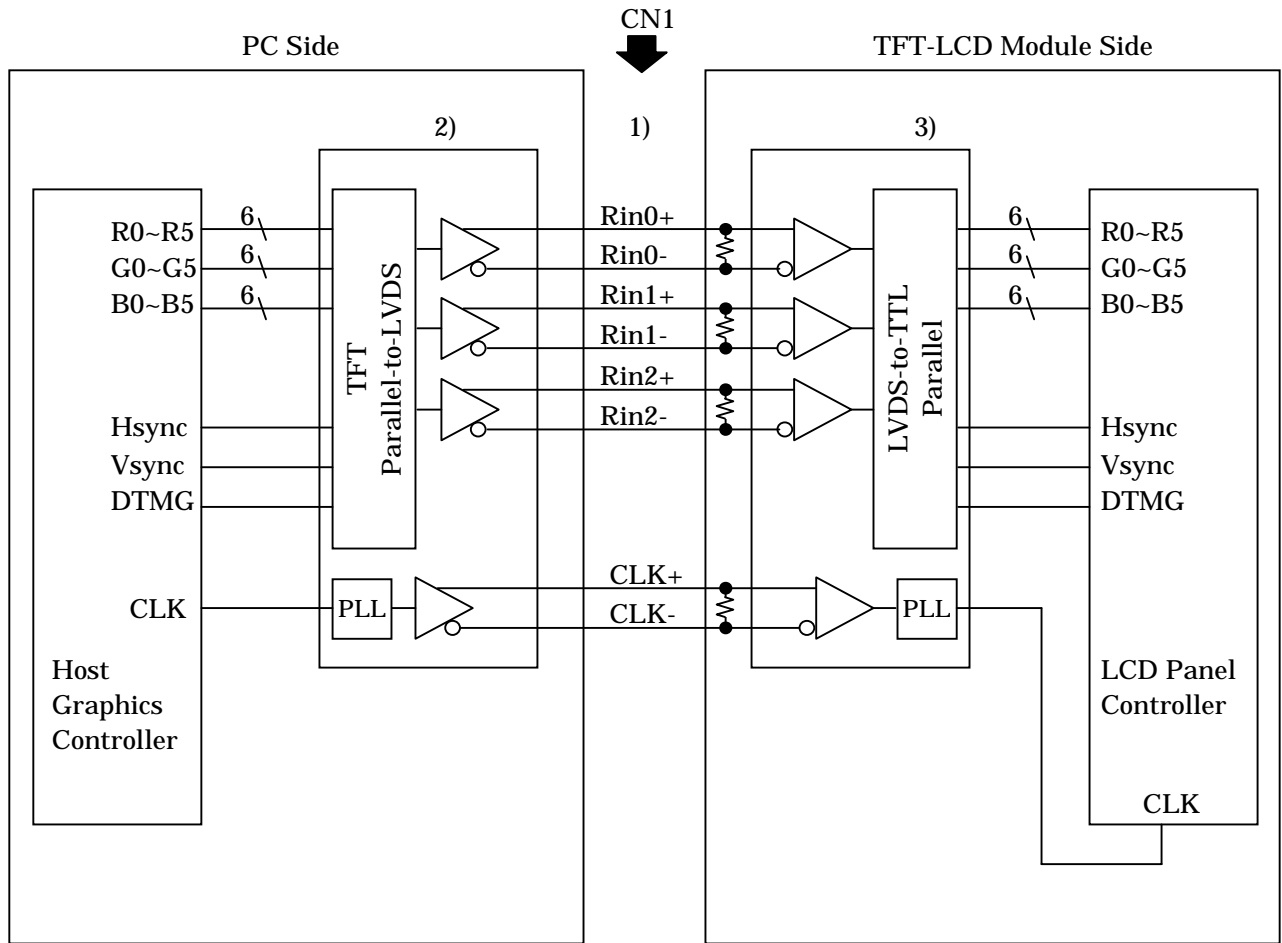
3) Keep open. Hitachi test use only.

5.2 BACK-LIGHT UNIT

CN2 <<JST: BHSR-02VS-1>> (Mating side connector: SM02B-BHSS)

Pin No.	Symbol	Function	Note
1	V _L	Power Supply	Cable Color: Pink
2	GND	GND (0V)	Cable Color: White

LVDS INTERFACE

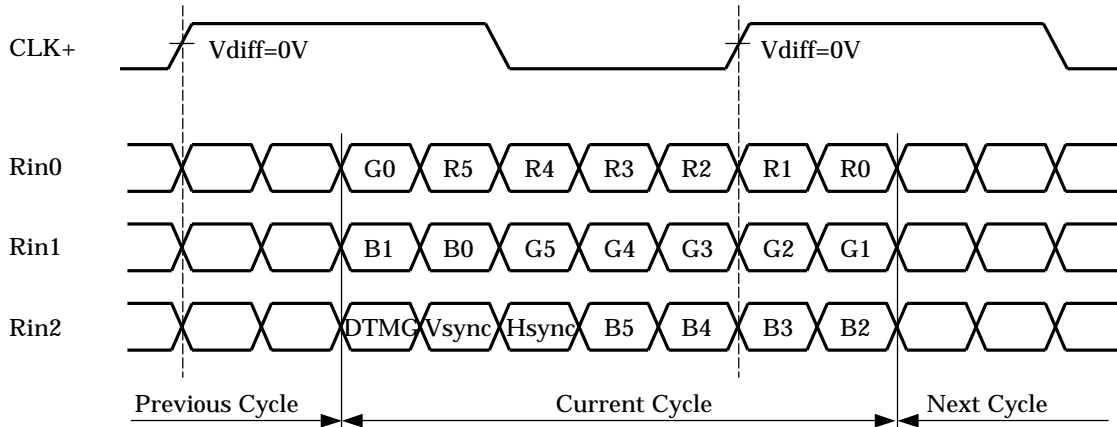


Notes 1) LVDS cable impedance is 50 ohms per signal line or about 100 ohms when two are used differentially.

2) Transmitter A diagram of INPUT SIGNAL FOR LVDS (ref. Page 8-3/4) should be transmitter output.

3) Receiver Thine THC63LVDF64A, or equivalent

INPUT SIGNAL FOR LVDS



$$\text{CLK} = (\text{CLK+}) - (\text{CLK-})$$

$$\text{RinX} = (\text{RinX+}) - (\text{RinX-}) \quad (\text{X} = 0, 1, 2)$$

Pin connection in case of using

THine THC63LVDF63A

Signal	Transmitter pin No. THC63LVDF63A
CLK	CLK IN (26)
R0	TA0 (44)
R1	TA1 (45)
R2	TA2 (47)
R3	TA3 (48)
R4	TA4 (1)
R5	TA5 (3)
G0	TA6 (4)
G1	TB0 (6)
G2	TB1 (7)
G3	TB2 (9)
G4	TB3 (10)
G5	TB4 (12)
B0	TB5 (13)
B1	TB6 (15)
B2	TC0 (16)
B3	TC1 (18)
B4	TC2 (19)
B5	TC3 (20)
HSYNC	TC4 (22)
VSUNC	TC5 (23)
DTMG	TC6 (25)

Note 1) Transmitter () Valves show IC pin No.

RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT DATA

Input data Color		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 (0)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green (0)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue (0)	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	
	Red (62)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
	Red (61)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Red (2)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	
	Red (1)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
	Red (0)	1	1	1	1	1	1	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	
	Green (62)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
	Green (61)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Green (2)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	
	Green (1)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	
	Green (0)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue (62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Blue (61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	
	Blue (0)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	

Notes 1) Definition of gray scale :

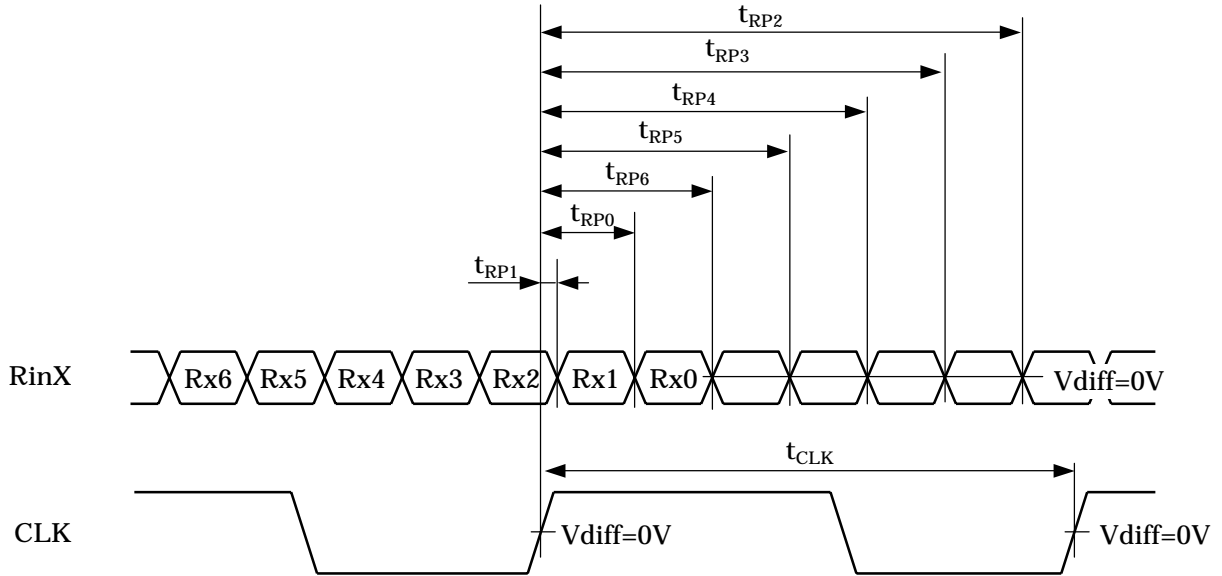
Color (n) --- n indicates gray scale level.

Higher n means darker level.

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

6. INTERFACE TIMING

6.1 TIMING CHART (for LVDS Receiver)

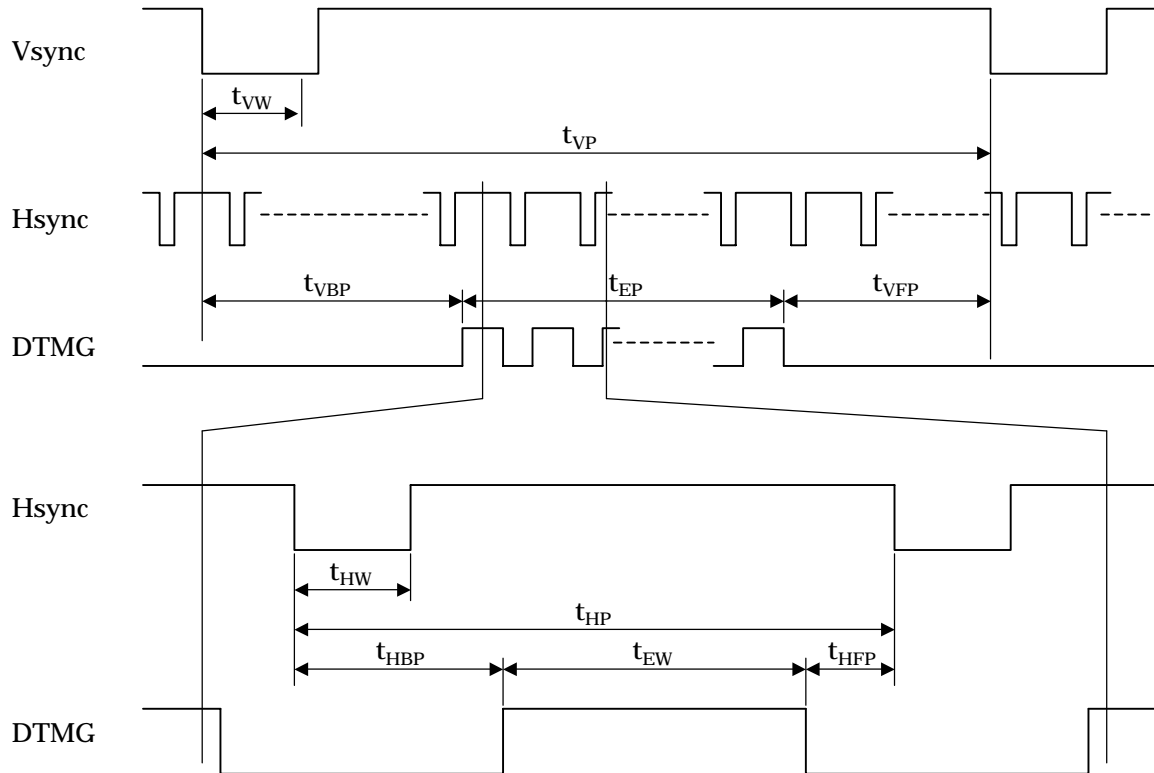


$$R_{inX} = (R_{inX+}) - (R_{inX-}) \quad (X = 0, 1, 2)$$

$$CLK = (CLK+) - (CLK-)$$

Item	Symbol	Min.	Typ.	Max.	Unit	Note
CLK	FREQUENCY	$1/t_{CLK}$	20	65	68	MHz
R_{inX} ($X = 0, 1, 2$)	Data position 0	t_{RP1}	-0.49	0	+0.49	ns
	Data position 1	t_{RP0}	$1/7t_{CLK}-0.49$	$1/7t_{CLK}$	$1/7t_{CLK}+0.49$	
	Data position 2	t_{RP6}	$2/7t_{CLK}-0.49$	$2/7t_{CLK}$	$2/7t_{CLK}+0.49$	
	Data position 3	t_{RP5}	$3/7t_{CLK}-0.49$	$3/7t_{CLK}$	$3/7t_{CLK}+0.49$	
	Data position 4	t_{RP4}	$4/7t_{CLK}-0.49$	$4/7t_{CLK}$	$4/7t_{CLK}+0.49$	
	Data position 5	t_{RP3}	$5/7t_{CLK}-0.49$	$5/7t_{CLK}$	$5/7t_{CLK}+0.49$	
	Data position 6	t_{RP2}	$6/7t_{CLK}-0.49$	$6/7t_{CLK}$	$6/7t_{CLK}+0.49$	

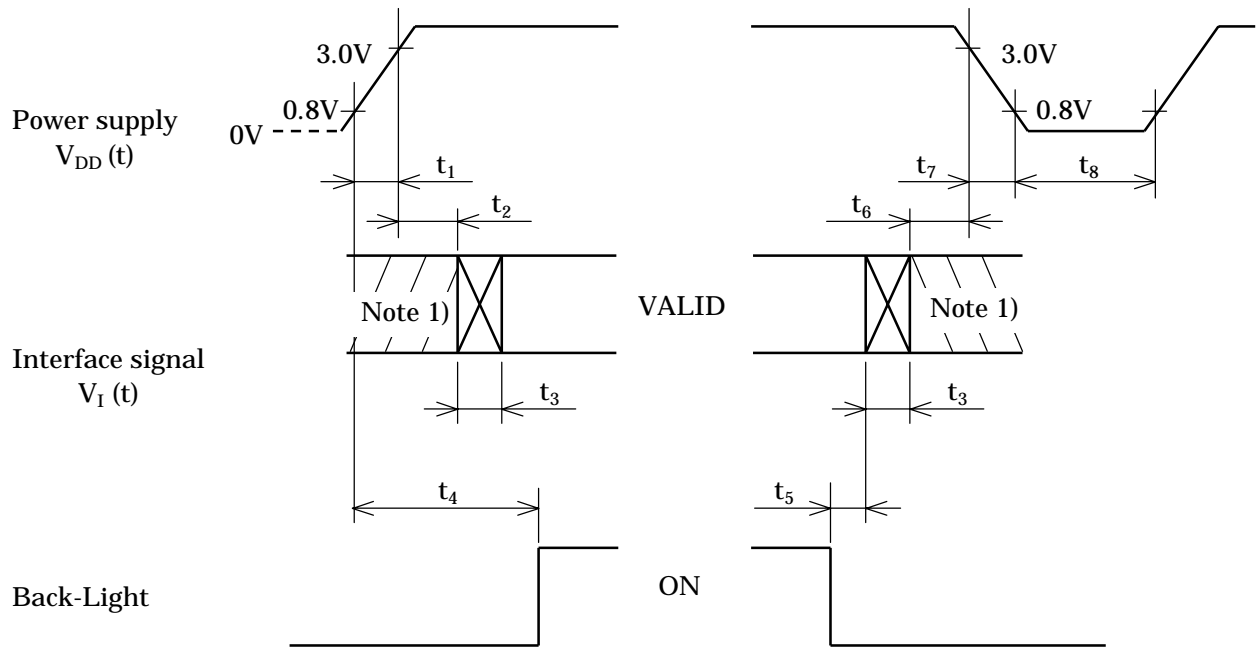
6.2 TIMING CHART (for Timing Converter)



Item		Symbol	Min.	Typ.	Max.	Unit	Note
Vsync	Period	t_{VP}	771	806	1,000	t_{HP}	
	Width-Active	t_{VW}	1	6	20		
Hsync	Period	t_{HP}	1,142	1,344	2,400	t_{CLK}	
	Width-Active	t_{HW}	8	136	160		
DTMG	1 Frame Pulse	t_{EP}	768	768	768	t_{HP}	1)
	Width-Active	t_{EW}	1,024	1,024	1,024	t_{CLK}	
	Vertical Back Porch	t_{VBP}	1	-	-	t_{HP}	
	Vertical Front Porch	t_{VFP}	1	-	-		
	Horizontal Back Porch	t_{HBP}	32	-	416	t_{CLK}	
	Horizontal Front Porch	t_{HFP}	4	-	-		

Note 1) $t_{VBP} + t_{VFP} \geq 3t_{HP}$

6.3 TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY



POWER ON
 $t_1 \leq 15\text{ms}$
 $0 < t_2 \leq 45\text{ms}$
 $0 < t_3 \leq 5\text{ms}$
 $0.1\text{s} \leq t_4$

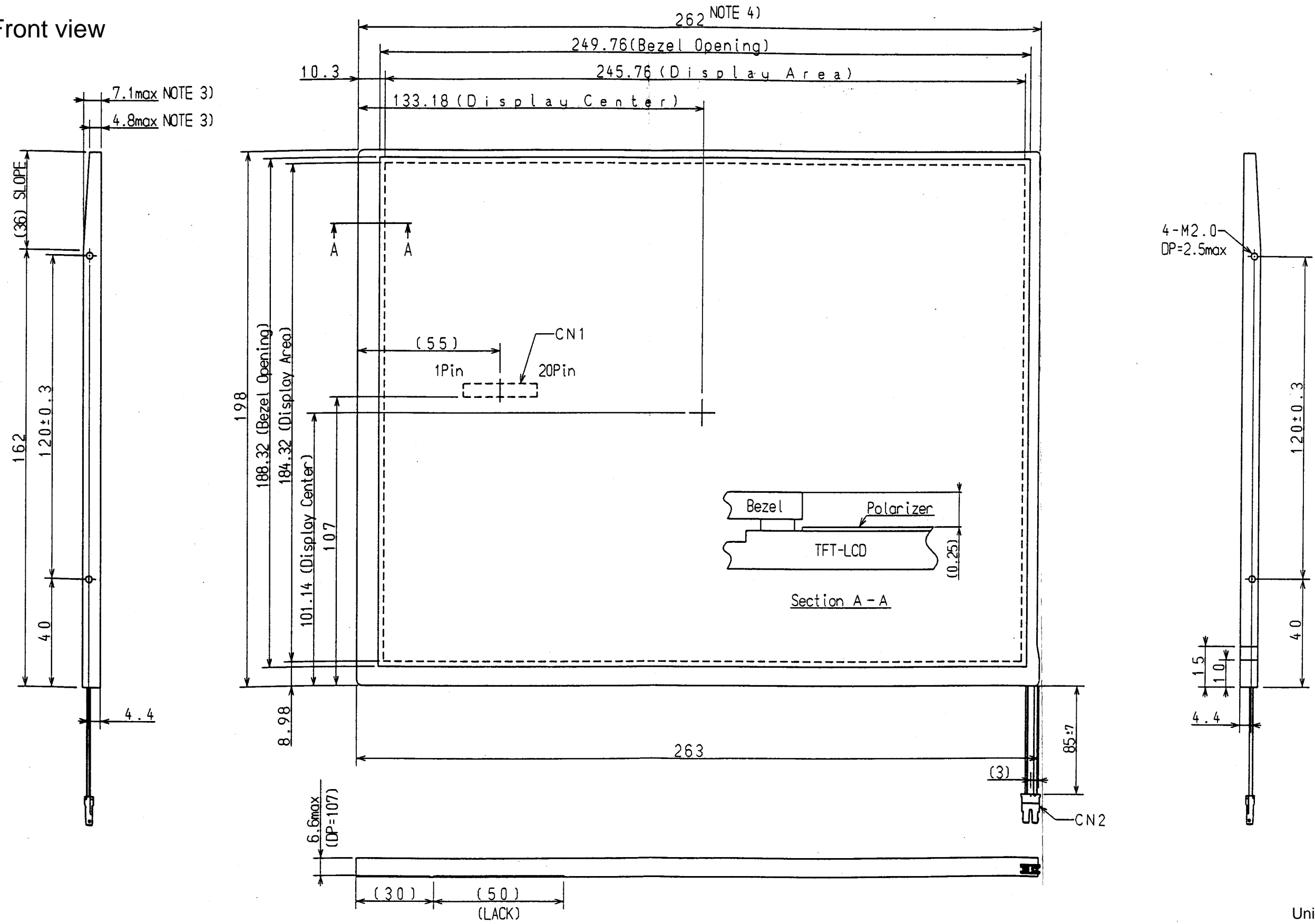
POWER OFF
 $5\text{ms} \leq t_5$
 $0 \leq t_6 \leq 45\text{ms}$
 $0 \leq t_7 \leq 20\text{ms}$
 $0.4\text{s} \leq t_8$

Notes 1) t_2 : Hi-Z (Hi-impedance) state

2) t_3 : Signal transition time from Hi-Z state to Valid state specified by 3 (1), 6 (1) and (2).

7. DIMENSIONAL OUTLINE

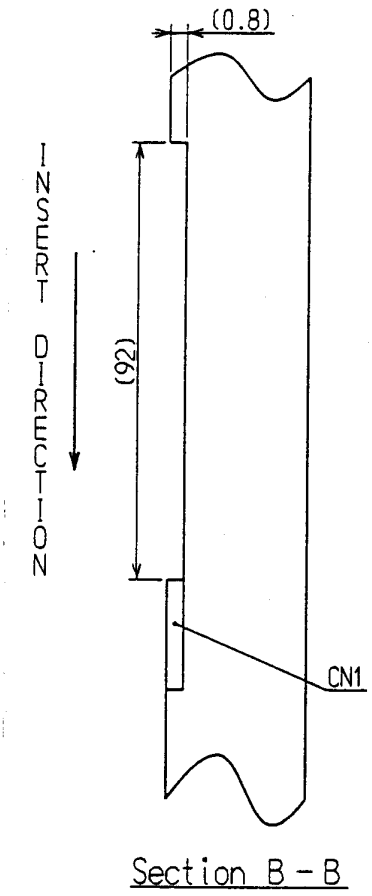
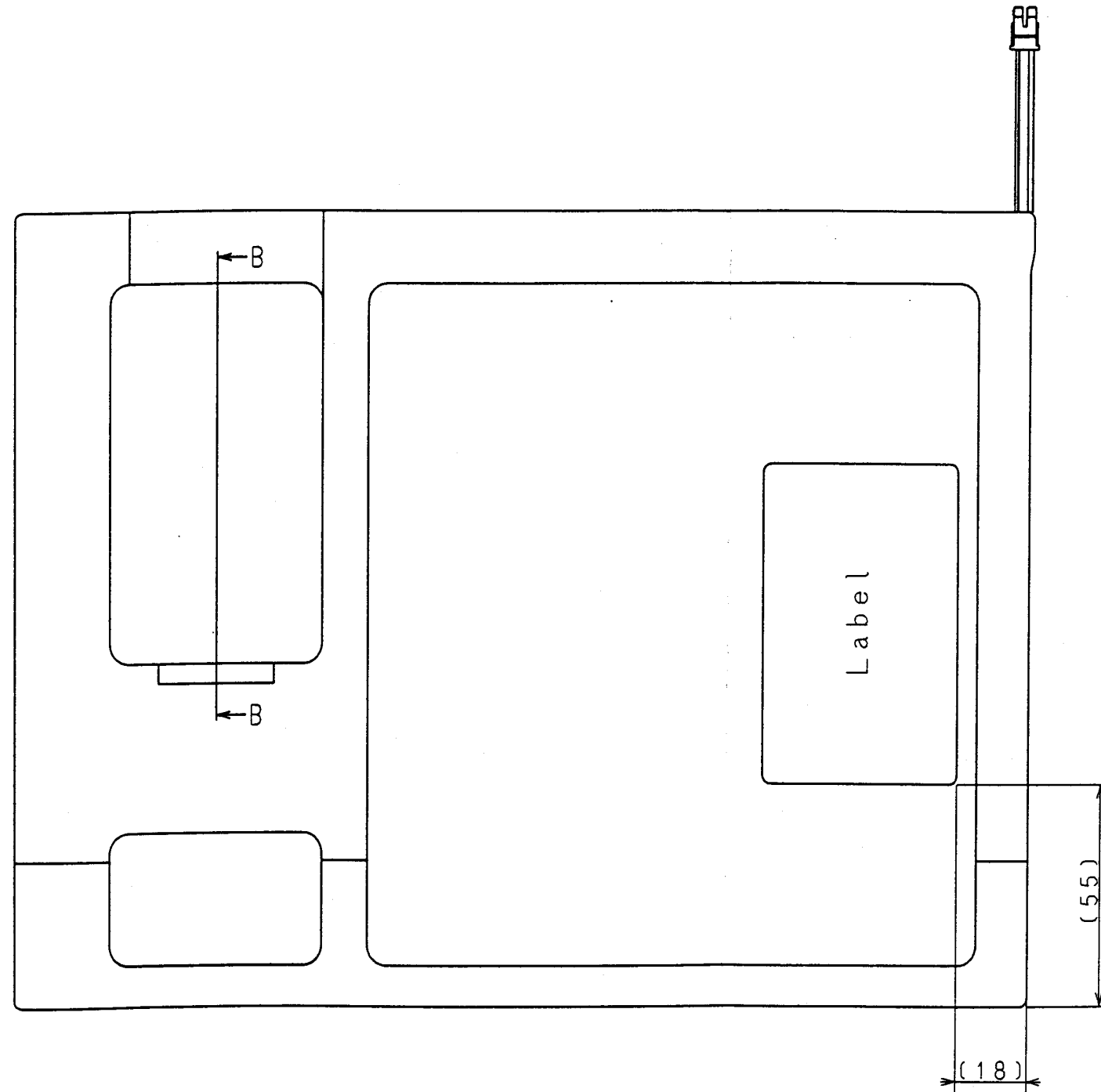
(1) Front view



- Notes 1) The unspecified tolerance: ± 0.5
- 2) Dimensions in parenthesis are reference value.
- 3) Dimension measurement should be done with adding pressure of 9.8×10^4 Pa
- 4) Tolerance of bend edge of bezel: ± 0.3

Unit : mm
Scale : NTS

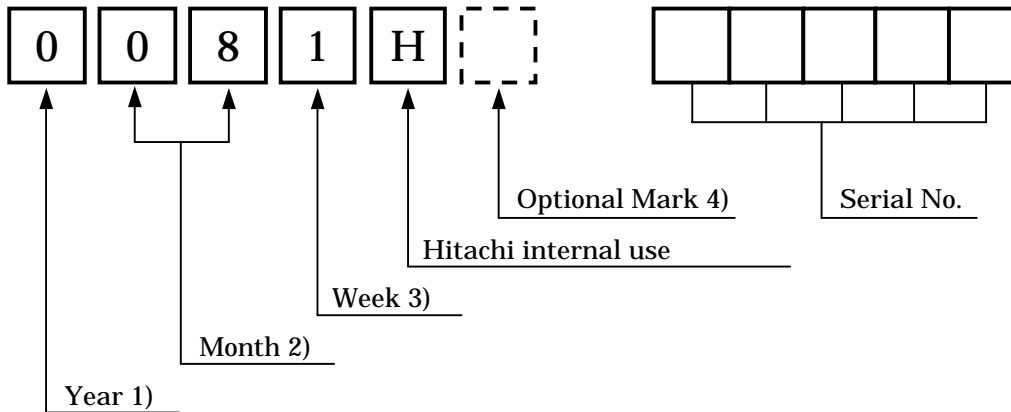
(2) Back view



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
2000	0
2001	1
2002	2
2003	3
2004	4

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) Optional Mark for Hitachi.

8.2 SERIAL NO.

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

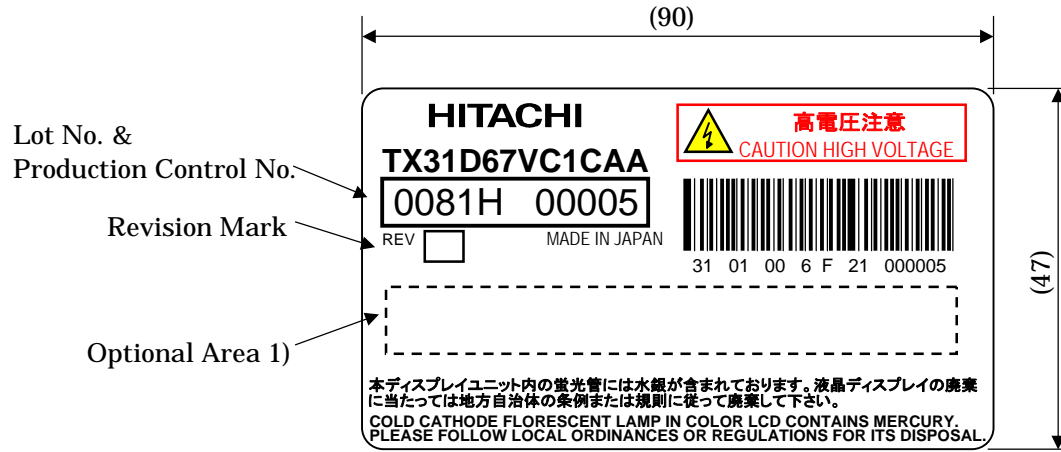
8.3 Revision

The revision is filled with A ~ Z except I, O.

By mutual (Customer, Hitachi) agreement, the blank of revision is filled with the specified alphabet if necessary.

8.4 LOCATION OF LOT MARK

Label is being attached on the back side of module.



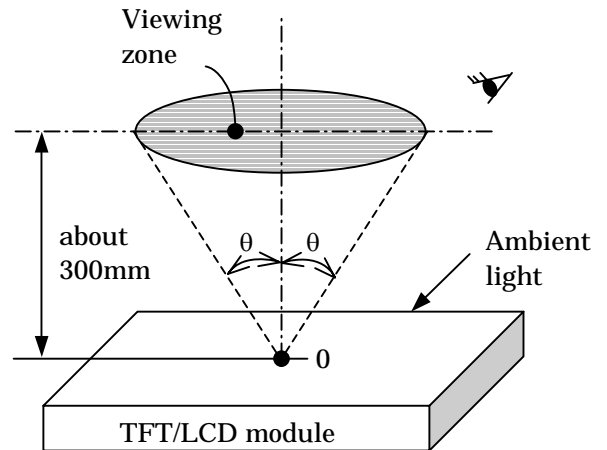
1) Optional Area for Hitachi.

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.
 - $\theta \leq 45^\circ$ when non-operating inspection
 - $\theta \leq 5^\circ$ 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)



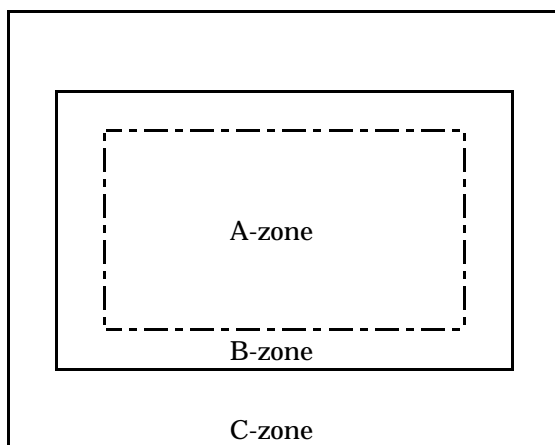
(2) Environmental

- i) Temperature : 25°C
When operating inspection, surface temperature of LCD panel is 25°C .
- ii) Ambient light : about 2000 [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		5	pcs	1), 2), 4)			
				1dot Green	3					
			2dots	3dots	4dots	Density	2	units	1), 2), 5)	
							1			
							0			
							2			pcs ϕ 20mm
			Total			5	pcs	1), 2)		
			Black mode	1dot	2dots	3dots	4dots	Density	pcs ϕ 20mm	1), 3), 4)
				Total			5	pcs	1), 3), 5)	
		Total			2	pcs ϕ 20mm	1), 3), 6)			
		Total			5	pcs	1), 3)			
		Total			8	pcs	1)			
		2	Line Defect			Serious one is no good.	-	-		
3	Uneven Brightness									
4	Stain Inclusion (Line shape W: width (mm) L: length (mm))	$W \leq 0.02$	L: Ignore	Ignore	pcs	7)				
			$W \leq 0.03$	$L \leq 2.0$			10			
		$W \leq 0.06$		$L > 2.0$			0			
			$L \leq 1.0$	10						
$L > 1.0$	0									
5	Stain Inclusion (Dot shape D: average dia.(mm))	$D \leq 0.22$		Ignore	pcs	7)				
		$D \leq 0.33$		5						
		$D > 0.33$		0						
6	Scratch on polarizer (Line shape W: width (mm) L: length (mm))	$W \leq 0.01$	L: Ignore	Ignore	pcs	8)				
			$W \leq 0.02$	$L \leq 40$			10			
		$W \leq 0.04$		$L > 40$			0			
			$L \leq 20$	10						
$L > 20$	0									
7	Scratch on polarizer (Dot shape D: average dia.(mm))	$D \leq 0.2$		Ignore	pcs	8)				
		$D \leq 0.4$		10						
		$D > 0.4$		0						

No.	Item	Maximum acceptable number		Note
		A-zone	Unit	
8	Bubbles, Peeling in Polarizer [D: average dia.(mm)]	$D \leq 0.3$	Ignore	pcs 8)
		$D \leq 0.5$	10	
		$D \leq 1.0$	5	
		$D > 1.0$	0	
9	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 dot : N defect dots are consecutive. (N means the number of defect dots.)

6) Density : number of defect dots inside $\phi 20\text{mm}$.

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

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

9) Afterimage The afterimage remaining longer than 10 seconds isn't allowed.

(When displayed Black raster, after fixed patterns displayed at 1 minute.
Ta=25°C)

10. PRECAUTIONS

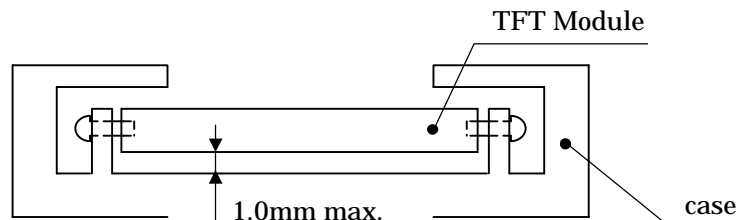
Please pay attention to the followings when you use this TFT/LCD module with Back-light unit.

10.1 MOUNTING PRECAUTION

- (1) You must mount Module using mounting holes arranged in 4 corners 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) The space between the backside of the module and the metal plate shall not be near.
- (12) Do not pull or do not fold the CFL cable.
- (13) Maximum torque for the screw: $0.34\text{N}\cdot\text{m}$

10.2 OPERATING PRECAUTION

- (1) The spike noise causes the miss-operation of circuits.
Recommended condition of spike noise level is as follows:
 $V_{DD} = \pm 200\text{mV}$, $V_I = \pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer).
And also Transmittance and Color depend on the temperature.
- (3) 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.
- (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 has 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

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 Interface pin directly.

10.4 PRECAUTION FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

Hitachi Displays, Ltd.	Date	Jan. 25, 2008	Sh. No.	DPBCL0001723-1	Page	13-2/4
------------------------	------	---------------	------------	----------------	------	--------

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 them to sunlight or fluorescent light.
Keep the temperature between 0°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 like chamois soaked with Isopropyl Alcohol.

Hitachi Displays, Ltd.	Date	Jan. 25, 2008	Sh. No.	DPBCL0001723-1	Page	13-3/4
------------------------	------	---------------	------------	----------------	------	--------

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.

10.8 RESERVE THE ENVIRONMENT (A WAY TO DESTROY)

- (1) The LCD Modules include Cold Cathode Fluorescent Lamp (CFL).
CFL contains a small amount of mercury. Please follow local ordinances or regulations for disposal.
- (2) Flex cable and printed wire board used in a module contain small amount of lead:
Therefore, handle them appropriately in case of disposal.

10.9 HANDLING PRECAUTIONS FOR MODULE

- (1) The module is took out when holding on Anti-Static Electricity Bag.
- (2) The cable for lamp (CFL) shall not be pull.
- (3) Display of the module shall not be held.

Hitachi Displays, Ltd.	Date	Jan. 25, 2008	Sh. No.	DPBCL0001723-1	Page	13-4/4
------------------------	------	---------------	------------	----------------	------	--------