HITACHI
Hitachi Displays, Ltd.

Date; Sep. 08, 2008

For IDK Corporation

TECHNICAL DATA

TX39D30VC1GAA

CONTENTS

RECORD OF REVISION

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APPLICATION

In the case of applying this product for such as control and safety device of transportation facilities (airplane, train, automobile, ship, etc), equipments aiming for rescue and security, and the other safety related devices which should secure higher reliability and safety, please make it sure that proper countermeasure such as fail-safe functions and enough system design for the protection are mandatory.

Please do not apply this product for equipments or devices which need exceedingly high reliability, such as aerospace applications, telecommunication facilities (trunk lines), nuclear related equipments or plants, and critical life support devices or applications. Usage style of this product is limited to Landscape mode. Optical characteristics mentioned in this spec. sheet is applied for only initial stage after delivery, and the characteristics will be changed by long time usage. Reliability of this product is secured as normal office use.

DESCRIPTION

This specification is applied to the following TFT Liquid Crystal Display Module with Back-light unit.

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

GENERAL SPECIFICATIONS

Type name	: TX39D30VC1GAA
Display Area	: (H)331.2 × (V)207.0 [mm]
Display Pixels (Display Dots)	: (H)1,280 × (V)800 pixels (H(1280 × 3) × V800 [dots])
Voltage of V_{DD}	: 3.3 V
Pixel Pitch	: (H)0.25875 × (V)0.25875 [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	: (H)344.0 typ. × (V)225.0 typ. × (t)7.0max – 6.5max [mm]
Weight	: 590 typ. [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	-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	

Note 1) Environmental temperature and humidity of this unit, not of system installed with this unit.
At low temperature the brightness of CCFL drop and the life time of CCFL become to be short.

2) Ambient temp. Ta ≤ 40°C : 85%RH Max. without condensation.
Ta > 40°C : Absolute humidity must be lower than the saturated vapor of 85%RH at 40°C. Without condensation.

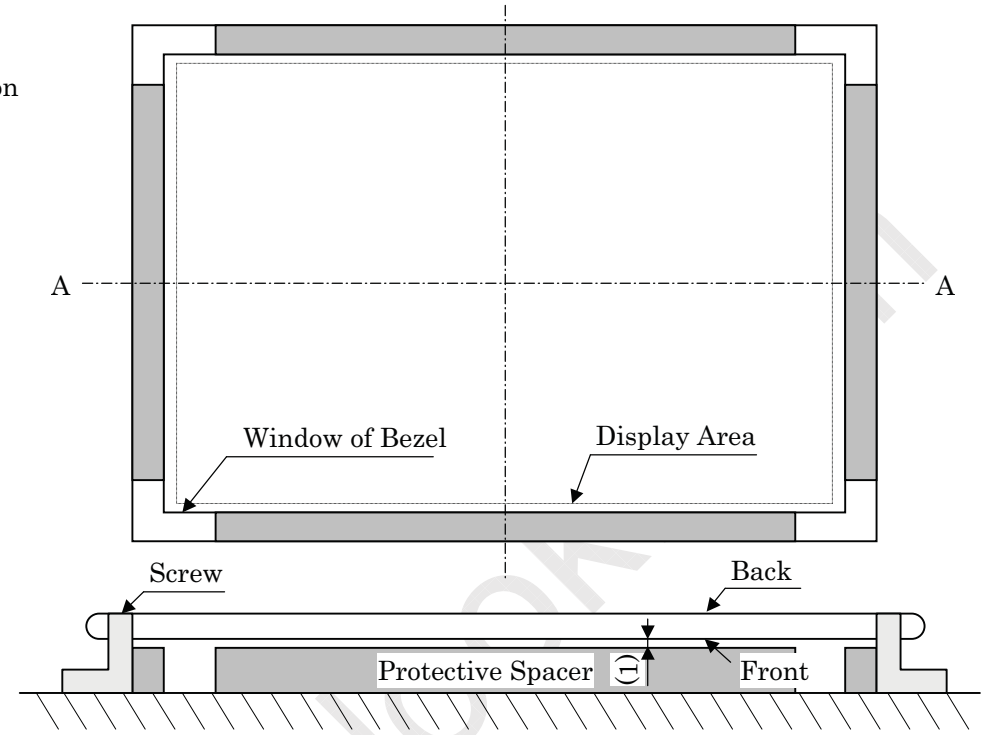
3) Vibration frequency : 20~50Hz. (Except resonance frequency)

4) 7ms of pulse width.

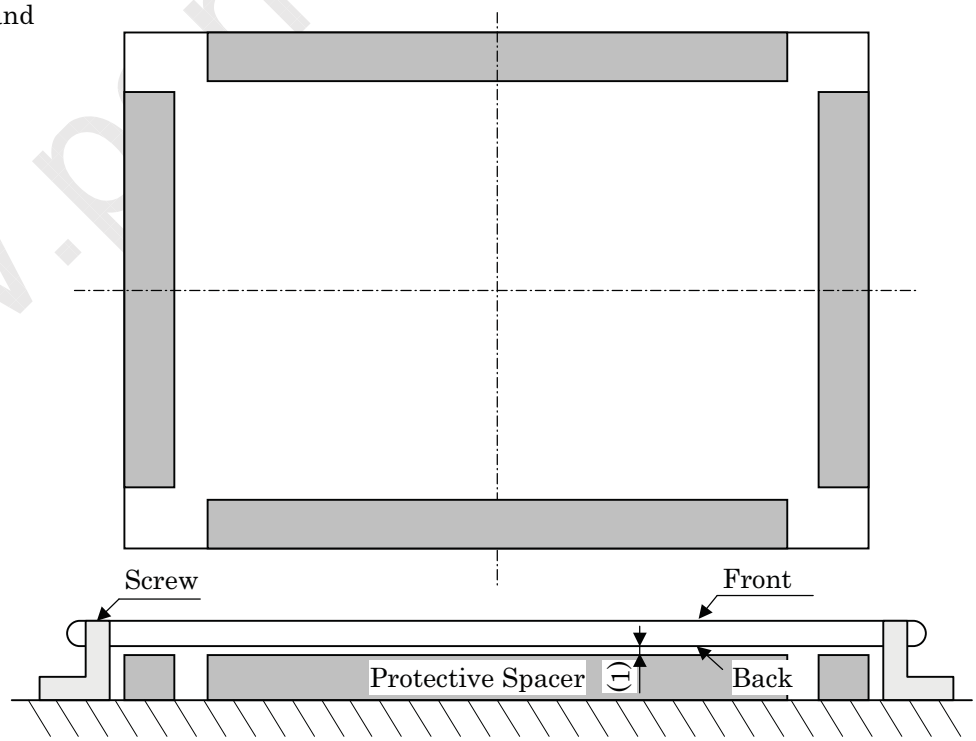
5) With mounting protective spacer (ref. page 4-2/3)

Adding protective spacer at shock & vibration test
Shaded area is to be supported with additional spacer.

(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 other side



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}	±100		V	1)
	V_{ESD1}	±8		kV	2), 3)

Note 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	mArms
Lamp Voltage	V_L	0	2,000	Vrms

1.3 Connection between PC Ground and Metal frame.

Metal frame of the module should be grounded with PC's ground in case that protection film is being peeled off while operating the module.
Unless you connected between metal frame and PC's Ground.
PC's system happen to shut down due to the influence of electrostatic discharge caused by pealing off the protection film.

2. OPTICAL CHARACTERISTICS

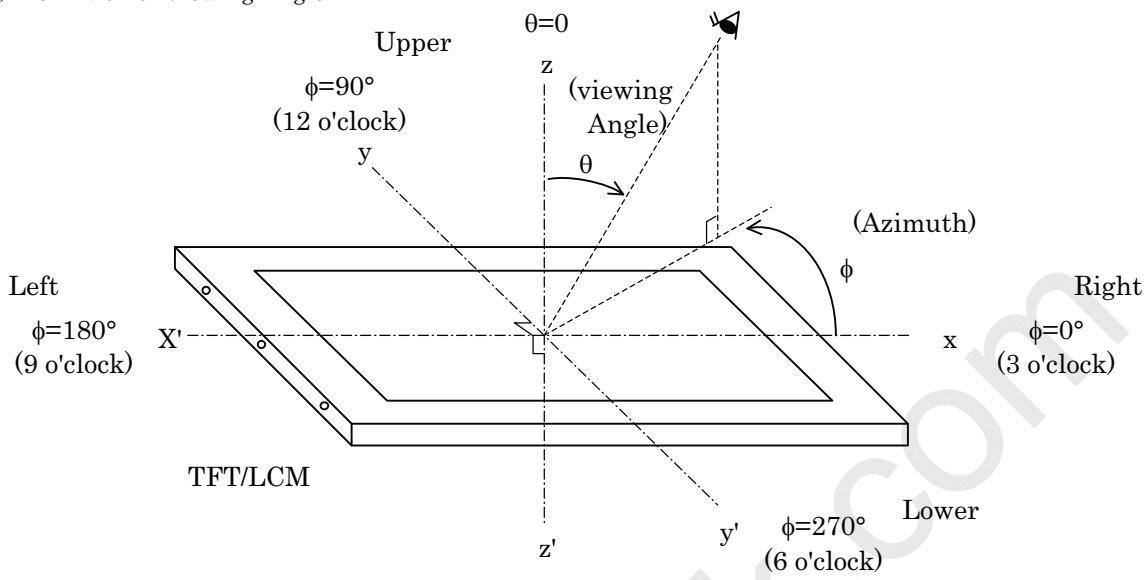
The following items are measured on the conditions that this unit operation (TFT panel and Back-light) and measuring systems are stable. (more than 30minites' operation)
The ambient light excluding The Back-light unit is nothing.

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

Temperature of LCD=25°C, V_{DD}=3.3V, f_V=60Hz, f_L=70kHz, I_L=6mA(Average of two CCFL)

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ=0° Note 1)	–	600	–	–	2)
Response Time	Rise	tr		–	18	–	ms	3)
	Fall	tf		–	7	–		
Brightness (white)		Bwh		450	520	–	cd/m^2	
Color of CIE	Red	x		0.62	0.65	0.68	–	
		y		0.29	0.32	0.35		
	Green	x		0.27	0.30	0.33		
		y		0.58	0.61	0.64		
	Blue	x		0.11	0.14	0.17		
		y		0.05	0.08	0.11		
	White	x		0.29	0.32	0.35		
		y		0.30	0.33	0.36		
Viewing Angle (CR≥10)	x-x'	θx	ϕ = 0°	60	80	–	deg.	1)
		θx'	ϕ = 180°	60	80	–		
	y-y'	θy	ϕ = 90°	30	50	–		
		θy'	ϕ = 270°	40	60	–		

Note 1) Definition of Viewing Angle

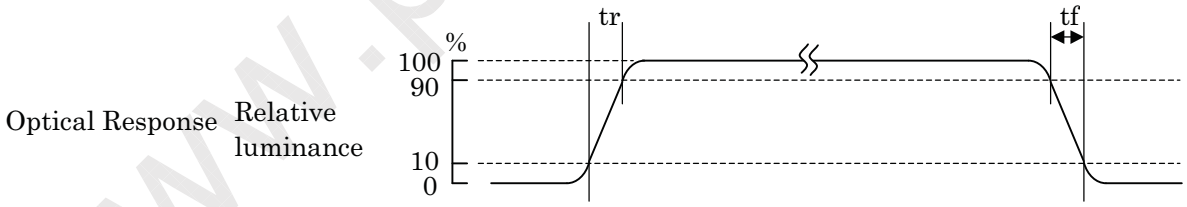


2) Definition of Contrast Ratio (CR)

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

These Brightness is measured on the center of screen.
* Measurement in the darkroom.

3) Definition of Response Time



3. ELECTRICAL CHARACTERISTICS

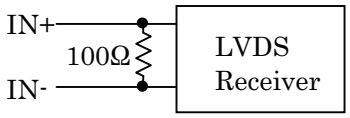
(1) TFT LIQUID CRYSTAL DISPLAY MODULE Ta=25°C, Vss=0V

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}	–	315	600	mA	2), 3)
Vsync Frequency		f_V	–	60	62	Hz	4), 5)
Hsync Frequency		f_H	–	48.7	51	kHz	4)
DCLK Frequency		f_{CLK}	58	71	73	MHz	4)

Note 1) VCM=+1.25V

VCM is common mode voltage of LVDS transmitter/receiver.

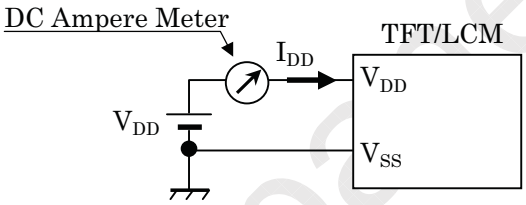
The input terminal of LVDS transmitter is terminated with 100Ω.



2) fv=60Hz, f_{CLK}=71MHz, 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 trouble happens. (larger than 3.0A.)

4) For LVDS Transmitter Input

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

Flicker level will be worse by shift of Vsync Frequency.

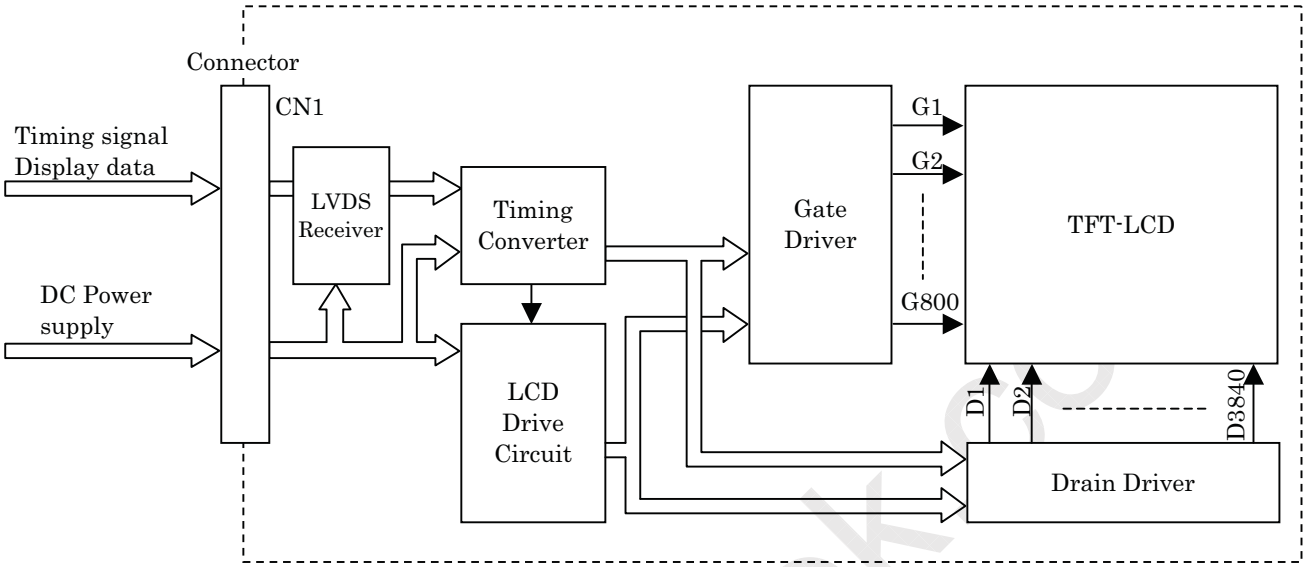
(2) BACK-LIGHT UNIT Ta=25°C, GND=0V

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	–	740	–	Vrms	
Frequency	f_L	40	–	70	kHz	3)
Starting Lamp Voltage	Vs	1150	–	–	Vrms	4)
		1380	–	–		4), 5)

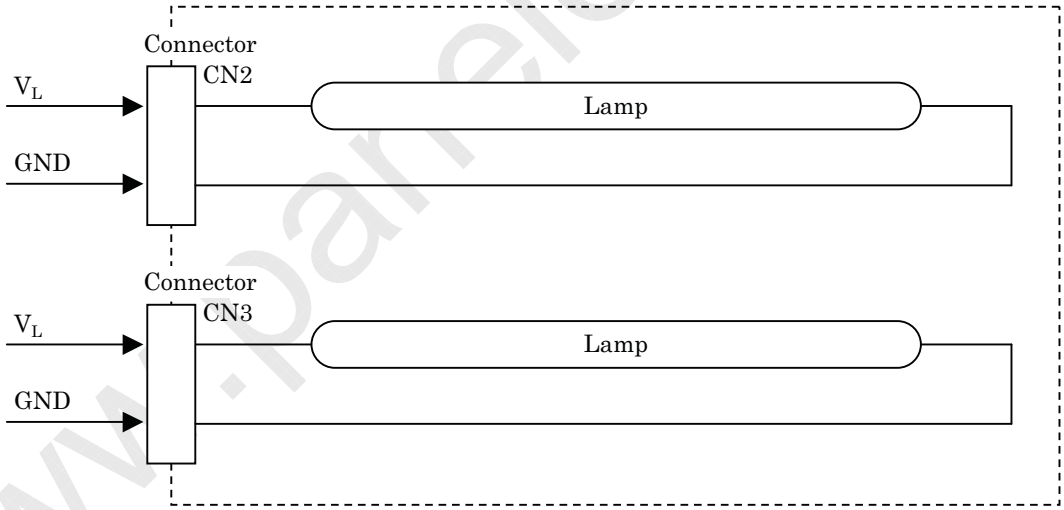
Notes 1) The specification shall be applied to each CCFL. The specification is defined at ground line.
2) Higher I_L cause the short life time of CCFL.
3) Lighting frequency for a CCFL may cause the interference with scanning frequency and cause beat or flicker on the display. Therefore, Lighting frequency shall be as different as possible from scanning frequency in order to avoid the interference.
4) Starting Lamp Voltage should be more than V_S (Min.).
5) Ta=0°C
6) Distribution difference of CCFLs surface temperature should be less than 5°C.
7) When the lighting wave form of the inverter is asymmetry, the inclination of mercury is generated. Therefore, please adjust the imbalance factor (|IP-I-P|/Irms×100) of the lighting current wave form to 10% or less, and adjust the crest factor (IP (or I-P)/Irms) to 1.2~1.6.
8) The lighting wave form of the inverter is in-phase in a lamp unit.

4. BLOCK DIAGRAM

(1) TFT LIQUID CRYSTAL DISPLAY MODULE



(2) BACK-LIGHT UNIT



5. INTERFACE PIN CONNECTION

(1) TFT LIQUID CRYSTAL DISPLAY MODULE

CN1 <<JAE FI-XB30SL-HF10>>

Pin No.	Symbol	Function
–	VSS	Ground
1		
2	VDD	Power Supply 3.3V (typical)
3		
4	VSS	Ground
5	VSS	Ground
6	VSS	Ground
7	VSS	Ground
8	Rin0-	LVDS Receiver Signal (-)
9	Rin0+	LVDS Receiver Signal (+)
10	VSS	Ground
11	Rin1-	LVDS Receiver Signal (-)
12	Rin1+	LVDS Receiver Signal (+)
13	VSS	Ground
14	Rin2-	LVDS Receiver Signal (-)
15	Rin2+	LVDS Receiver Signal (+)
16	VSS	Ground
17	CLK-	LVDS Clock Signal(-)
18	CLK+	LVDS Clock Signal(+)
19	VSS	Ground
20	NC	NC
21	NC	NC
22	VSS	Ground
23	NC	NC
24	NC	NC
25	VSS	Ground
26	NC	NC
27	NC	NC
28	VSS	Ground
29	NC	NC
30	NC	NC
–	VSS	Ground

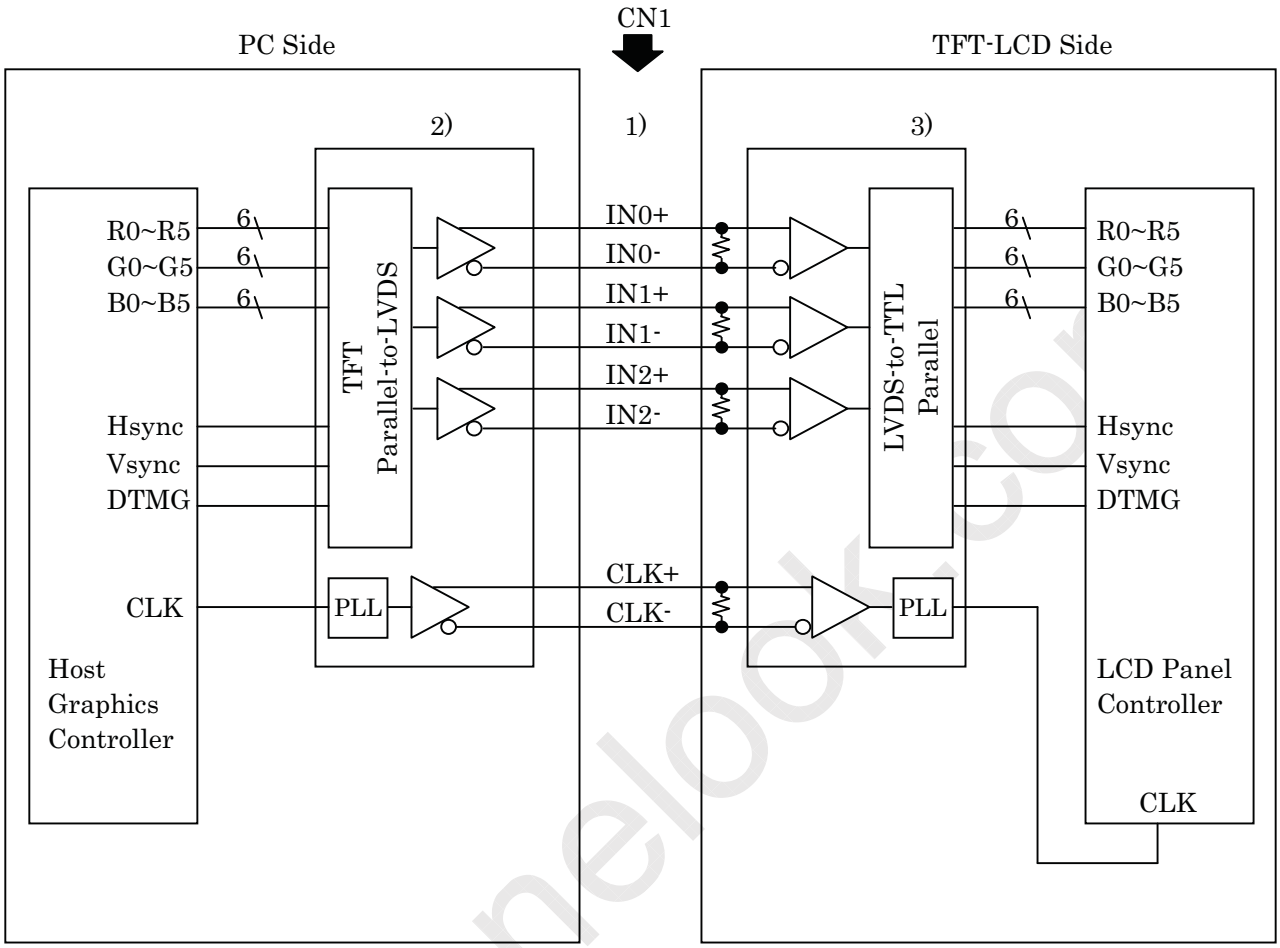
Note 1) All VSS pins should be connected to GND (0V).
Metal bezel is connected internally to VSS.
2) All VDD pins should be connected to +3.3V.
3) All NC pins should be kept Open.

(2) BACK-LIGHT UNIT

CN2, CN3 <<JST BHSR-02VS-1>>

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

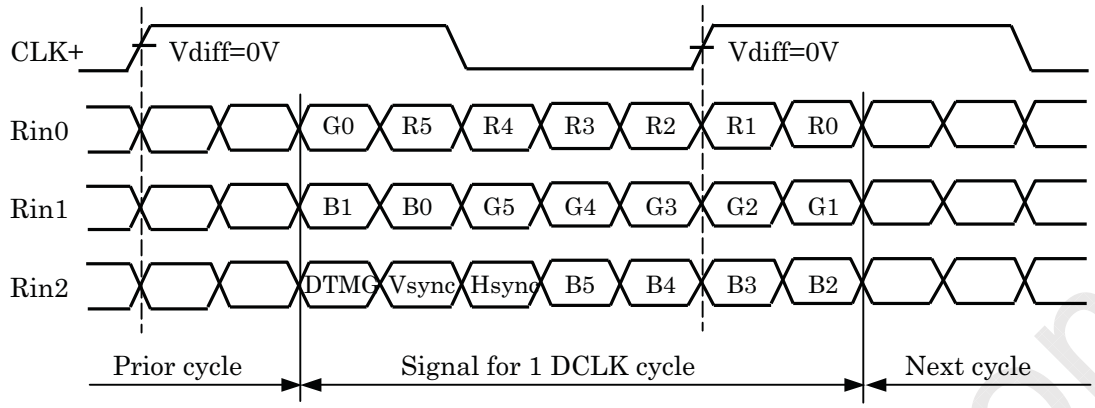
LVDS INTERFACE



Note 1) LVDS cable impedance should be 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).

LVDS Input Signal



CLK = (CLK+) – (CLK-)
RinX = (RinX+) – (RinX-) (X=0, 1, 2)
Pin connection in case of using
SN75LVDS84

	INPUT SIGNAL	Transmitter
	R0	IN0(44)
	R1	IN1(45)
L	R2	IN2(47)
V	R3	IN3(48)
D	R4	IN4(1)
S	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)
	DCLK	CLK IN(26)

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

Note 1) Definition of gray scale :

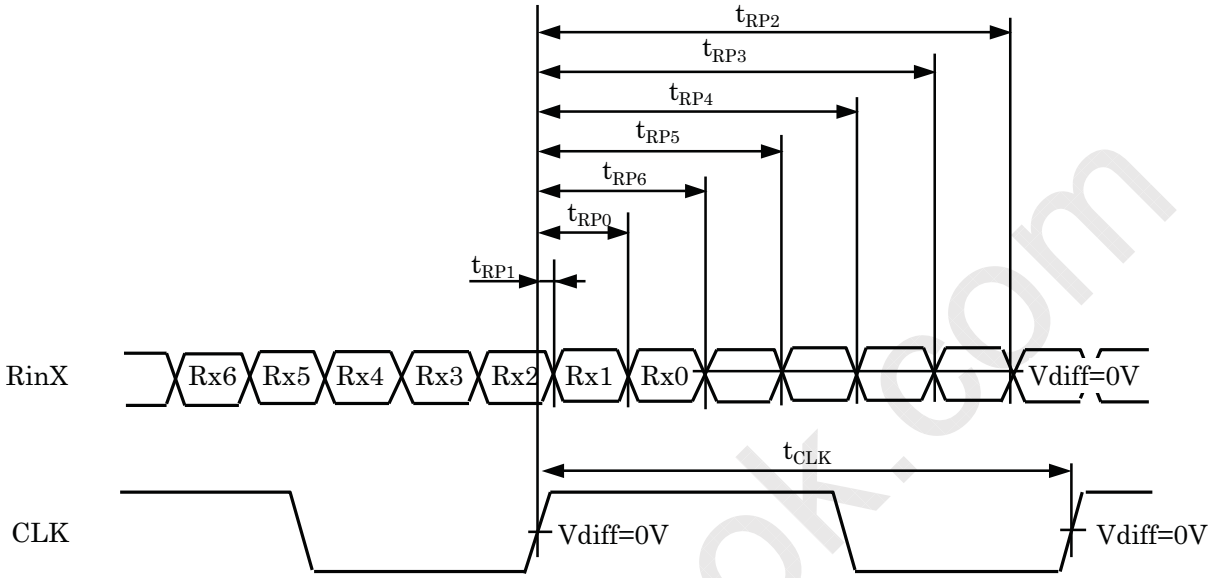
Color (n) --- number in parenthesis indicates gray scale level.

Larger number corresponds to brighter level.

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

6. INTERFACE TIMING

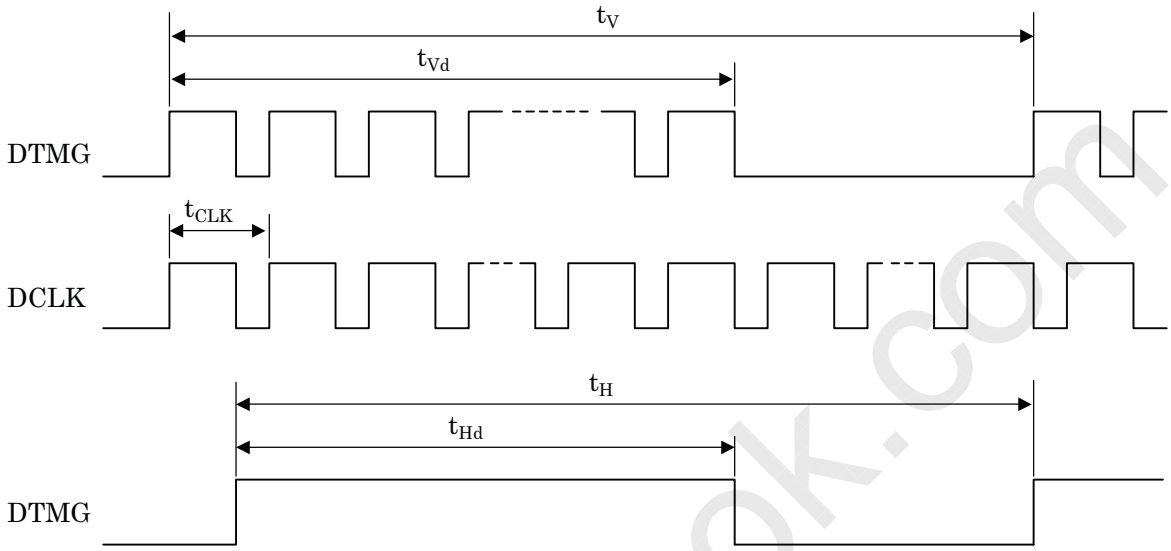
(1) LVDS receiver timing
(Interface of TFT module)



RinX=(RinX+)–(RinX-) (X=0,1,2)
CLK=(CLK+)–(CLK-)

Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	FREQUENCY	$1/t_{CLK}$	58	71	73	MHz	
RinX (X=0,1,2)	0 data position	t_{RP0}	$1/7t_{CLK}$–0.49	$1/7t_{CLK}$	$1/7t_{CLK}$+0.49	ns	
	1st data position	t_{RP1}	-0.49	0	+0.49		
	2nd data position	t_{RP2}	$6/7t_{CLK}$–0.49	$6/7t_{CLK}$	$6/7t_{CLK}$+0.49		
	3rd data position	t_{RP3}	$5/7t_{CLK}$–0.49	$5/7t_{CLK}$	$5/7t_{CLK}$+0.49		
	4th data position	t_{RP4}	$4/7t_{CLK}$–0.49	$4/7t_{CLK}$	$4/7t_{CLK}$+0.49		
	5th data position	t_{RP5}	$3/7t_{CLK}$–0.49	$3/7t_{CLK}$	$3/7t_{CLK}$+0.49		
	6th data position	t_{RP6}	$2/7t_{CLK}$–0.49	$2/7t_{CLK}$	$2/7t_{CLK}$+0.49		

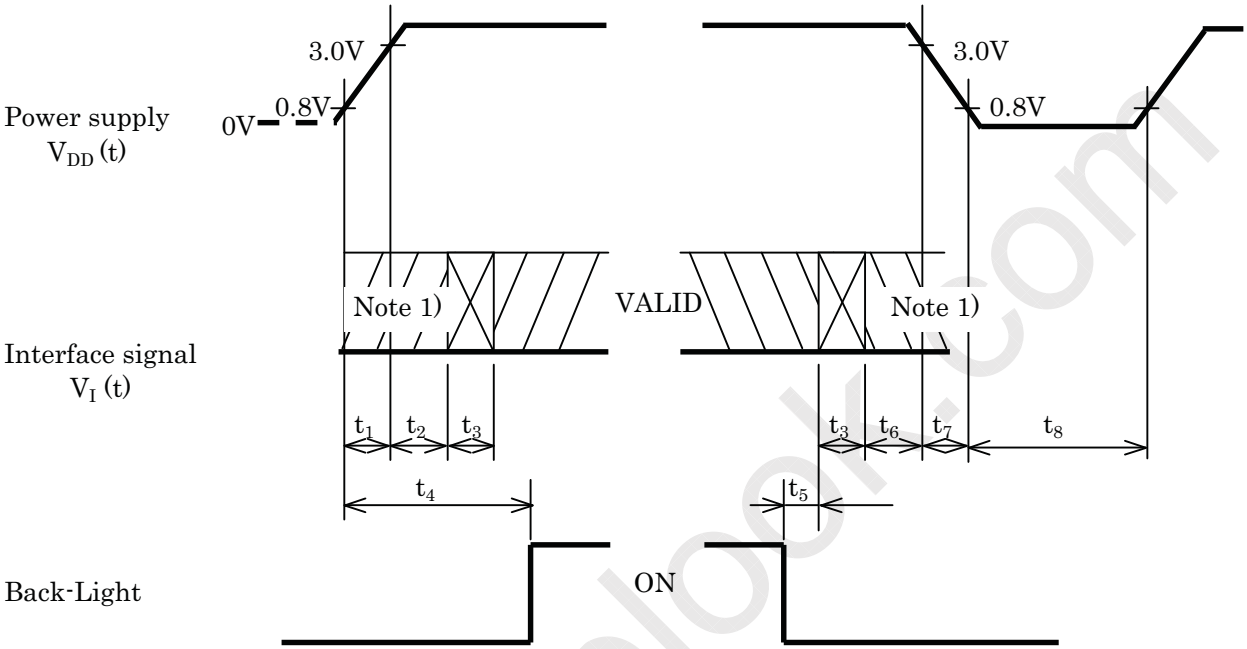
(2) timing converter timing
(Input timing for transmitter)



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

Item		Symbol	Min.	Typ.	Max.	Unit
DCLK	Cycle time	t_{CLK}	13.7	14.1	17.3	ns
DTMG	Line cycle time	t_H	1,440	1,456	1,560	t_{CLK}
	Line width-Active	t_{Hd}	1,280	1,280	1,280	
	Frame cycle time	t_V	802	812	850	l_{ine}
	V width-Active	t_{Vd}	800	800	800	

(3) TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY



POWER ON	POWER OFF
$0 < t_1 \leq 15ms$	$5ms < t_5$
$0 < t_2 \leq 45ms$	$0 < t_6 \leq 45ms$
$0 < t_3 \leq 5ms$	$0 < t_7 \leq 20ms$
$0.1s < t_4$ Note3)	$0.4s < t_8$

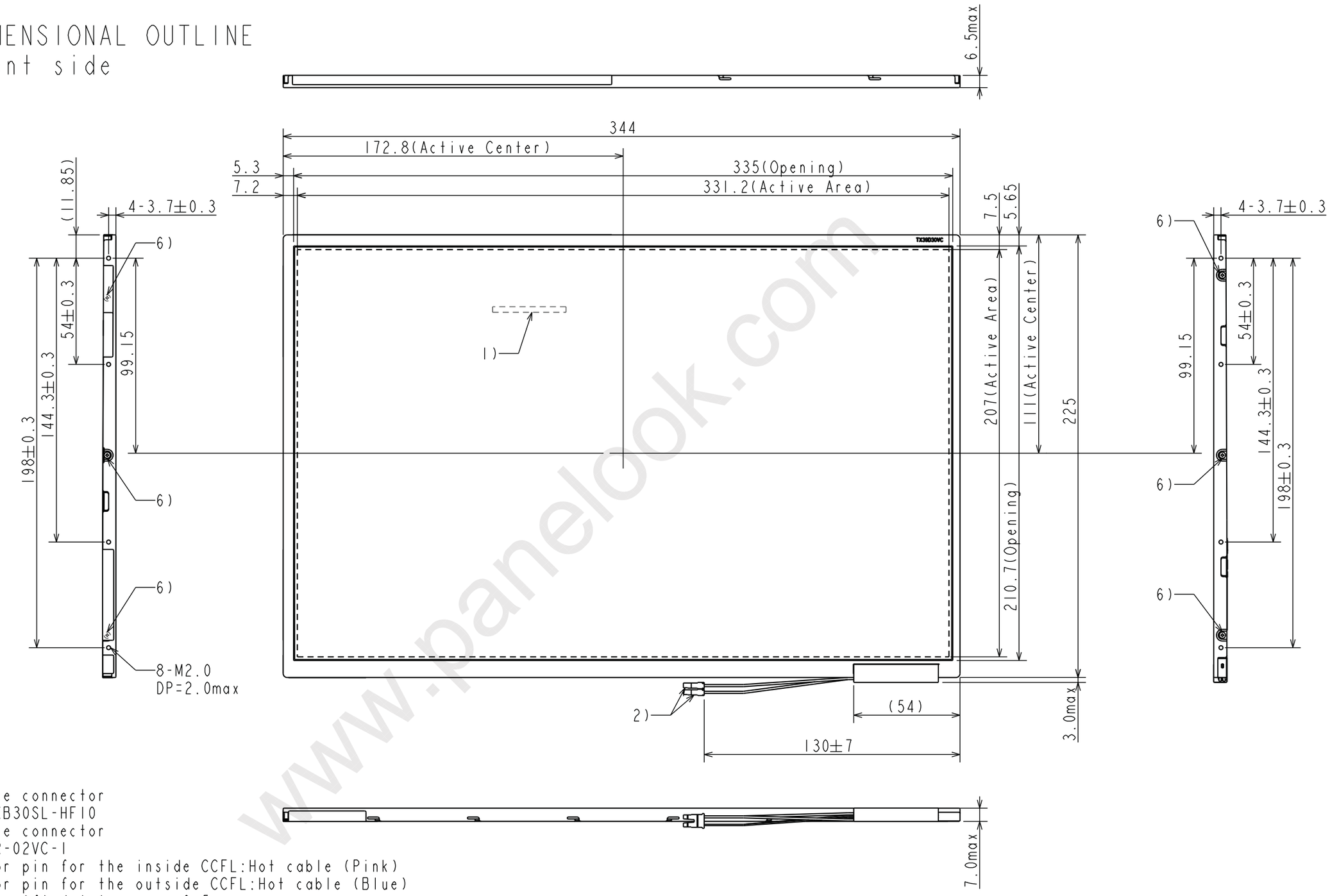
Note 1) t2: Hi-Z (Hi-impedance) state

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

3) Recommended value.

7. DIMENSIONAL OUTLINE

Front side



NOTE

1) Interface connector
   JAE:FI-XB30SL-HF10
2) CFL cable connector
   JST:BHSR-02VC-1
   Connector pin for the inside CCFL:Hot cable (Pink)
   Connector pin for the outside CCFL:Hot cable (Blue)
3) The unspecified tolerance:±0.5
4) Hole in mounting panel:8 holes
5) Maximum torque for the screw in mounting panel:0.196N·m(2.0kgf·cm)
6) There are 6 screws that are attached to the module.
7) Dimension measurement should be done with
   adding pressure of 9.8x10000[Pa](1kgf/cm2)

UNIT:mm

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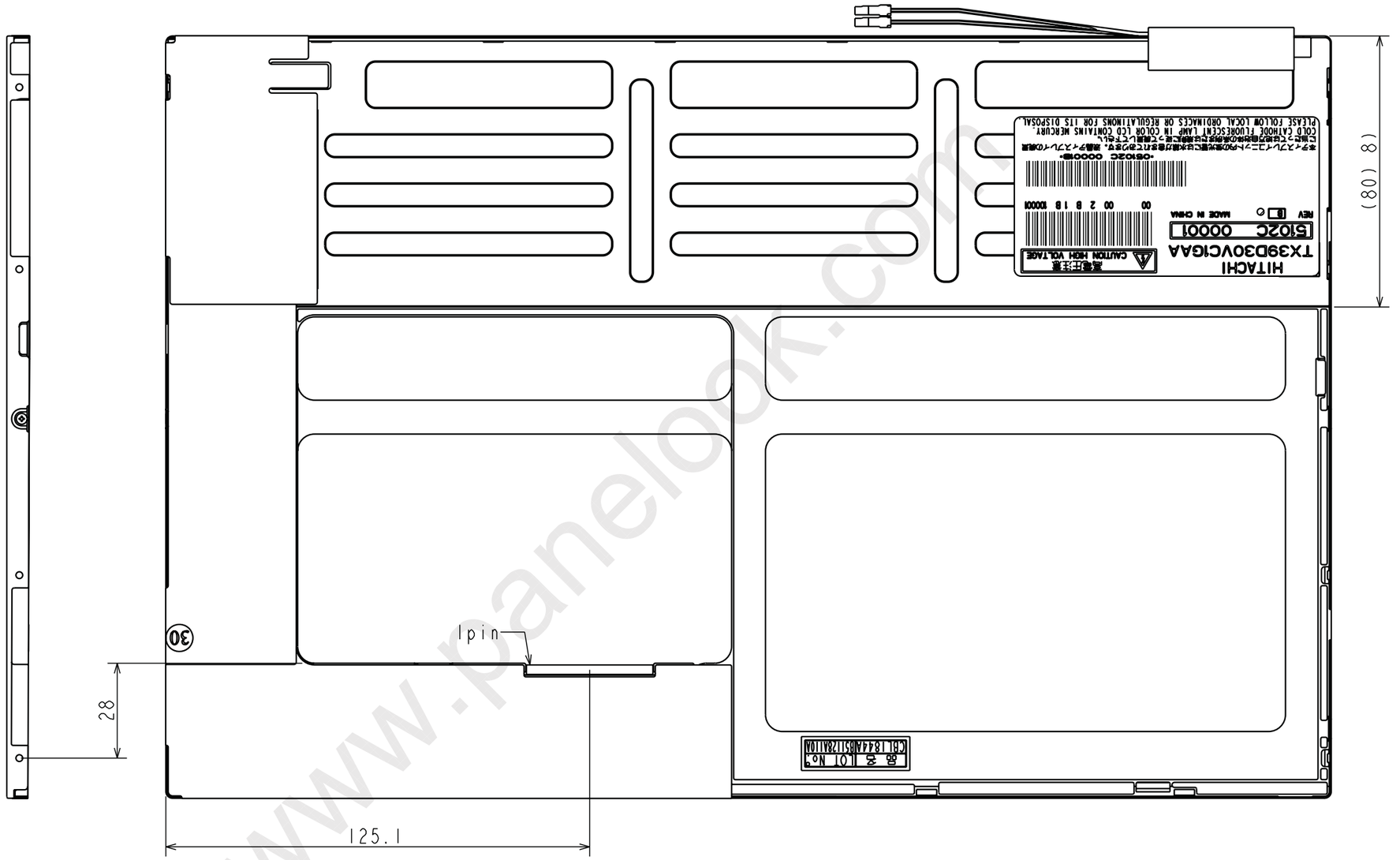
Back side



NOTE
8)Starting point of the slant on the module back side.

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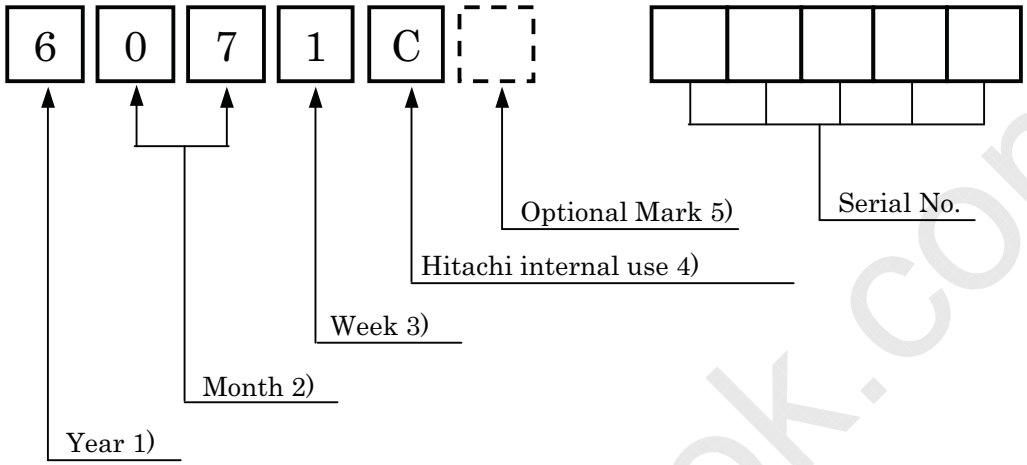
8. DESIGNATION OF LOT MARK

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)

C	Made in CHINA
H	Made in JAPAN

5) Optional Mark for Hitachi.

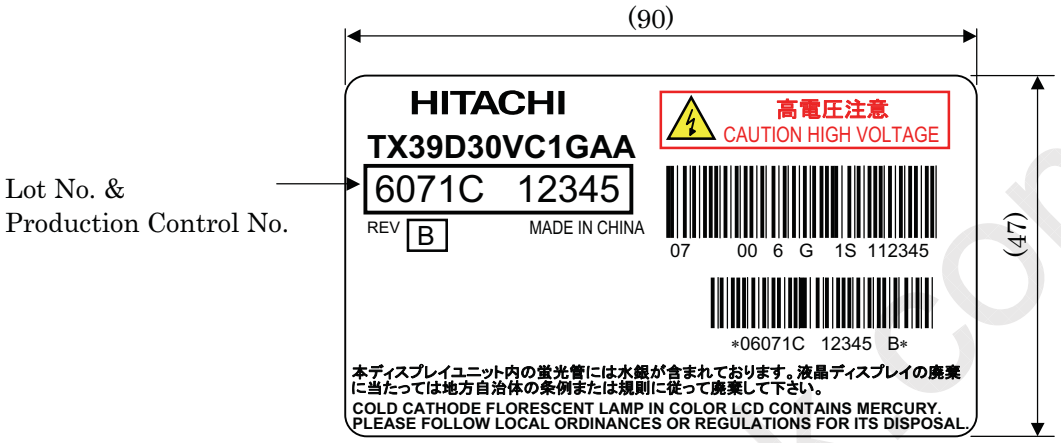
8.2 Serial No.

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.

The items mentioned change without notice.



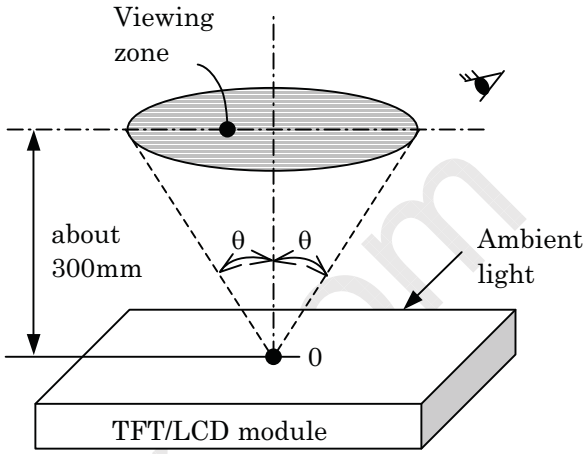
9. COSMETIC SPECIFICATIONS

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

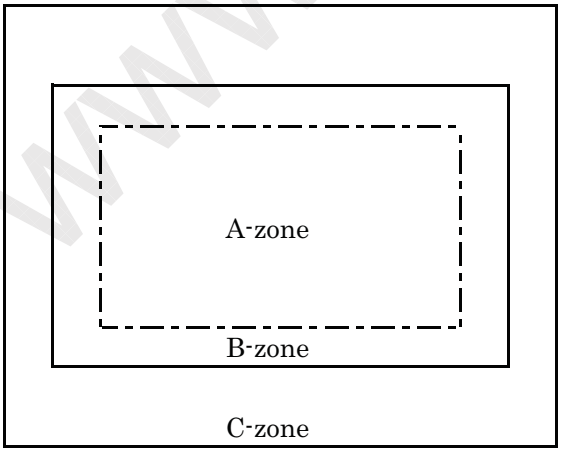
i) Temperature : 25°C
When operating inspection, surface temperature of LCD panel is 25°C

ii) Ambient light : More than 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		0	pcs	1), 2), 4)
			2dots		0	units	1), 2), 5)
			3dots		0		
			4dots		0		
			Density		0	units ϕ15mm	1), 2), 6)
			Total		0	pcs	1), 2)
		Black mode	1dot		7	pcs	1), 3), 4)
			2dots		1	units	1), 3), 5)
			3dots		0		
			4dots		0		
			Density		1	units ϕ15mm	1), 3), 6)
			Total		7	pcs	1), 3)
		Whole Total			7	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 ≤ 0.02	L: Ignore	Ignore	pcs	7)
			W ≤ 0.03	L ≤ 2.0	10		
				L > 2.0	0		
			W ≤ 0.06	L ≤ 1.0	10		
				L > 1.0	0		
			W > 0.06	–	See the No.5 Dot shape		
5	Stain Inclusion (Dot shape, D: average dia.(mm))		D ≤ 0.22		Ignore	pcs	7)
			D ≤ 0.5		5		
			D > 0.5		0		
6	Scratch on polarizer (Line shape, W: width (mm), L: length (mm))		W ≤ 0.02	L: Ignore	Ignore	pcs	8)
			W ≤ 0.03	L ≤ 40	10		
				L > 40	0		
			W ≤ 0.06	L ≤ 20	10		
				L > 20	0		
7	Scratch on polarizer (Dot shape, D: average dia.(mm))		D ≤ 0.2		Ignore	pcs	8)
			D ≤ 0.5		10		
			D > 0.5		0		

No.	Item		Maximum acceptable number		Note
			A-zone	Unit	
8	Bubbles, Peeling in Polarizer [D: average dia.(mm)]	D ≤ 0.3	Ignore	pcs	8)
		D ≤ 0.5	10		
		D ≤ 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 ϕ15mm.
7) Those stains which can be wiped out easily are acceptable.
8) Polarizer area inside of B zone is not applied.

10. PRECAUTION

Please pay attention to the followings when a TFT module with a back-light unit is used, handled and mounted.

10.1 PRECAUTION TO HANDLING AND MOUNTING

(1) Applying strong force to a part of the module may cause partial deformation of frame or mold, and cause damage to the display.

(2) The module should gently and firmly be held by both hands. Never hold by just one hand in order to avoid any internal damage. Never drop or hit the module. Never press the glass surface.

(3) The module should be installed with mounting holes of a module. Usage style of this product is limited to Landscape mode. If not CCFL life time may become shorter. Screw torque should be within spec.

(4) Uneven force such as twisted stress should not be applied to a module when a module is mounted on the cover case. The cover case must have sufficient strength so that external force can not be transmitted directly to a module.

(5) It is recommended to leave about 1mm space between a module and a cover case so that partial force is not applied to a module.

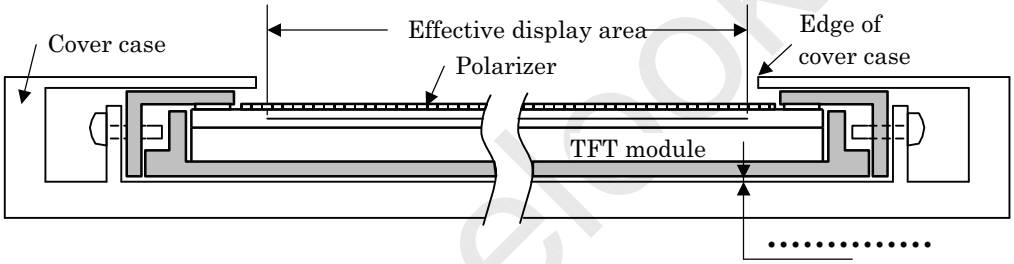


Fig.1 Cross sectional view of a monitor set

(6) The edge of a cover case should be located inside more than 1mm from the edge of a module front frame.

(7) For the surface protection purpose, place transparent protection plate. Then this plate should not be touched to LCD active area.

(8) Materials included acetic acid and chlorine should not be used for a cover case as well as other parts and boards near a module. Acetic acid attacks a polarizer. Chlorine attacks electric circuits due to electro-chemical reaction.

(9) The polarizer on a TFT cell should carefully be handled due to its softness, and should not be touched, pushed or rubbed with glass, tweezers or anything harder than HB pencil lead.
The surface of a polarizer should not be touched and rubbed with bare hand, greasy clothes or dusty clothes.

(10) The surface of a polarizer should be gently wiped with absorbent cotton, chamois or other soft materials slightly contained petroleum benzene when the surface becomes dirty. Isopropyl alcohol as cleaning chemicals is recommended in order to clean adhesives which fix front/rear polarizers on a TFT cell. Other cleaning chemicals such as acetone, toluene and Normal-hexane should not be used to clean adhesives because they cause chemical damage to a polarizer.

(11) Saliva or water drops should be immediately wiped off. Otherwise, the portion of a polarizer may be deformed and its color may be faded.

(12) The module should not be opened or modified. It may not work properly when module is modified. If the module is once opened or modified, warranty of the module becomes invalid and Hitachi doesn't guarantee its quality and reliability.

(13) Metal frame of a module should not be handled with bare hand or dirty gloves. Otherwise, color of a metal frame may become dirty during its storage. It is recommended to use clean soft gloves and clean finger stalls when a module is handled at incoming inspection process and production (assembly) process.
(14) Lamp (CCFL) cables should not be pulled and held.
(15) During transportation, do not place LCD module at face down or face up. Because strong shock may cause functional failure at above condition.

10.2 PRECAUTION TO OPERATION

(1) The ambient temperature near the operated module should be satisfied with the absolute maximum ratings. Unless it meets the specifications, sufficient cooling system should be adopted to system.
(2) The spike noise causes the miss-operation of a module. The level of spike noise should be as follows: -200mV ≤ over- and under- shoot of VDD ≤ +200mV
VDD including over- and under- shoot should be satisfied with the absolute maximum ratings.
Ripple voltage of inverter should be within electrical characteristics spec.
(3) Optical response time, luminance and chromaticity change depend on the temperature of a TFT module. Optical response time becomes longer at lower temperature operation.
(4) Starting lamp voltage becomes higher under low temperature condition. Also saturation time from power on will become longer.
(5) Sudden temperature change may cause dew on and/or in the a module. Dew makes damage to a polarizer and/or electrical contacting portion. Dew causes deterioration of display quality.
(6) Fixed pattern on display for a long time may cause after-image. It will be recovered with time.
(7) A module has high frequency circuits. Sufficient suppression to electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be effective to minimize the interference.
(8) Noise may be heard when a back-light is operated. If necessary, sufficient suppression should be done by system manufacturers.
(9) The Interface connector should not be connected or removed while a main system works. Otherwise, it may cause functional failure.

10.3 ELECTROSTATIC DISCHARGE CONTROL

(1) Since a module consists of a TFT cell and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, person who is handling a module should be grounded through adequate methods such as a list band. I/F connector pins should not be touched directly with bare hands.
(2) Protection film for a polarizer on a module should be slowly peeled off so that the electrostatic charge can be minimized.

10.4 PRECAUTION TO STRONG LIGHT EXPOSURE

(1) A module should not be exposed under strong light. Otherwise, characteristics of a polarizer and color filter in a module may be degraded.

10.5 PRECAUTION OF STORAGE, PACKAGE AND TRANSPORTATION

When modules such as service purposes, are stored for a long time, following precautions should be taken care of :

(1) Modules should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during storage. Modules should be stored at 5 to 35°C at normal humidity (60%RH or less).

(2) The surface of polarizer should not come in contact with any other object. It is recommended that modules should be stored in the Hitachi's shipping box.

10.6 PRECAUTION OF HANDLING PROTECTION FILM

(1) The protection film for polarizer should be pealed off slowly and carefully by person who is electrically grounded with adequate methods such as a list band. Besides, ionized air should be blown over during peeling action. Dusts on a polarizer should be blown off by an ionized nitrogen gun and so on.

(2) The protection film should be peeling off without rubbing it to the polarizer. Because, if the film is rubbed together with the polarizer, since the film is attached to the polarizer with a small amount of adhesive, the adhesive may remain on a polarizer.

(3) LCD module should not be stored at high temperature or high humidity condition. Because if protection film and polarizer film are attached long time Mura (non-uniformity) may occur.

(4) Stain can be removed easily with Isopropyl alcohol. Stain or its vestige on the polarizer should be wiped off with absorbent cotton or other soft materials such as chamois slightly contained Isopropyl alcohol.

10.7 WIPING FOR POLARIZER'S SURFACE

Polarizer with low reflection layer is lowered of reflection on LCD surface by AR coat on anti glare layer.

However charging for surface friction will be added more than normal coat by chemical composition on AR layer.

As a result, it is characteristic that are easier to absorption.

And hardness on AR layer is soft more than normal Polarizer.

Please be careful about handling.

10.8 SAFETY

(1) Since a TFT cell and lamps are made of glass, handling of the broken module should be taken care sufficiently in order not to be injured.
Hands should be washed sufficiently when liquid crystal material is attached to hands.

(2) The module should not be disassembled during operation so that back-light drives by high voltage.

(3) Inverter for driving CCFL should have over current/voltage detect circuit in case back-light failure happens. Also protection circuit should be verified on system side.

10.9 ENVIRONMENTAL PROTECTION

(1) The TFT module contains cold cathode fluorescent lamps. Please follow local ordinance or regulations for its disposal.

(2) Flexible circuits board and printed circuits board used in a module contain small amount of lead. Please follow local ordinance or regulations for its disposal.

10.10 USE RESTRICTIONS AND LIMITATIONS

(1) This product is not authorized for use in life support devices or systems, military applications or other applications which pose a significant risk of personal injury.

(2) In no event shall Hitachi Displays, Ltd., be liable for any incidental, indirect or consequential damages in connection with the installation or use of this product, even if informed of the possibility thereof in advance. These limitations apply to all causes of action in the aggregate, including without limitation breach of contact, breach of warranty, negligence, strict liability, misrepresentation and other torts.

10.11 OTHERS

(1) Electrical components which may not affect electrical performance are subjective to change without notice because of their availability.