

HITACHI

Hitachi Displays, Ltd.

Date: April 22, 2008

For _____

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX38D56VM1AAA

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Please return **1** copy with your signature on this page for approval.

Accepted by : _____ Proposed by: _____

Date : _____

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RECORD OF REVISION

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

DESCRIPTION

< 38cm (15.0inch) XGA >

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

General Specifications

Type name	: TX38D56VM1AAA
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
Viewing Angle	: 12 o'clock
Color Number	: 16770k Colors (6bit + FRC)
Dimensions Outlines	: (H)330.0 typ. × (V)260.0 typ. × (t)17.0 typ. [mm]
Weight	: 1300 typ. [g]
Interface	: 1ch-LVDS / Receiver (6bit or 8bit input) (Note 2)
Surface Polarizing Film	: Glare Polarizing Film (Hard Coat 3H: Pencil Hardness)
Back-light	: Four Cold Cathode Fluorescent Lamp (Side-Light type : Upper and Lower) Back-light inverter is not contained in Module.

Notes 1) Viewing Direction : Less inversion of gray scale.

2) LVDS : Low Voltage Differential Signaling.

• APPLICATION, WARRANTY PERIOD AND OTHERS

- (1) This LCD module was designed and manufactured to be used in an air-conditioned room away from direct sunlight.
- (2) This LCD module cannot be applied to an instrument which requires extremely high reliability and safety from its functions and precision. These instruments include medical equipment which affects life- and/or wealth-support apparatus.
- (3) Any problems caused by a use with deviation from the conditions mentioned in this specification are not included in the warranty.
- (4) Warranty period
The warranty period of this LCD module shall be 18 months from the manufacturing date. However, the backlight system is not included for problems other than initial failures. If the module is disassembled, we will not warrant any of these specifications including quality and safety sections. Because a reassembled or modified module may have foreign particles inside or its electronic circuit and/or electronic components may fail or malfunction.
- (5) Maintenance
This LCD module and the aforementioned data may be changed without notice. When you demand maintenance parts, please inquire about the changes in advance.
- (6) Repair
We will replace or repair all defective modules if the relevant defect is caused by Hitachi Displays. However, we will not take any responsibilities for defective modules after the expiration of warranty period. Also, if you access the modules for repairs, we will not warrant them either even if it is within the warranty period.
- (7) Failure in production and failure in the market
When a product which employs this LCD module is found to be a failure in the market, we will investigate the cause of the problem. If we find the LCD module is the cause of the failure, we will replace or refund the module.
- (8) Items in this specification may change for improvement without prior notice.
Please consult our sales division before engineering an instrument with this LCD module.
- (9) When a question arises concerning the specification, please contact our sales division.

1. ABSOLUTE MAXIMUM RATINGS

1.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Unit	Note
	Min.	Max.	Min.	Max.		
Ambient Temperature	-20	70	-20	70	°C	1)
Humidity	2)		2)		%RH	1)
Vibration	–	4.9 (0.5G)	–	19.6 (2G)	m/s ²	3)
Shock	–	29.4 (3G)	–	490 (50G)	m/s ²	4)
Corrosive Gas	Not Acceptable		Not Acceptable		–	
Illumination at LCD Surface	–	50,000	–	50,000	lx	

Notes 1) Temperature and Humidity should be applied to the glass surface of a TFT module, not of system installed with this unit.

Operating temperature means functional temperature without regard to optical performance.

Life characteristic is specified at 25±5 degree.

At low temperature the brightness of CFL drop and the life time of CFL become to be short.

(especially below 0 degree)

Storage at low temp : 48hr max.

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) Vibrating frequency : 20~50Hz.(Except resonance frequency)

4) 3ms, X•Y•Z•Z'.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

1.2.1 TFT LIQUID CRYSTAL DISPLAY MODULE

V_{SS}=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	0	4.0	V	
Input Voltage for logic	V _I	-0.2	V _{DD} +0.2	V	1)
Electrostatic Durability	V _{ESD0}	±100		V	2),3)
	V _{ESD1}	±8		kV	4),5)

Notes 1) It applies to the indicatory data signal terminal and the timing signal terminal.

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

1.2.2 BACK-LIGHT UNIT

GND=0V

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	I _L	0	7.0	mArms	1)
Lamp Voltage	V _L	0	1,500	V _{rms}	2)

Notes 1) It is stipulation on GND side.

- 2) The specification is applicable to connector pins of Back-Light unit.

1.3 CONNECTION BETWEEN SYSTEM GROUND AND METAL FRAME.

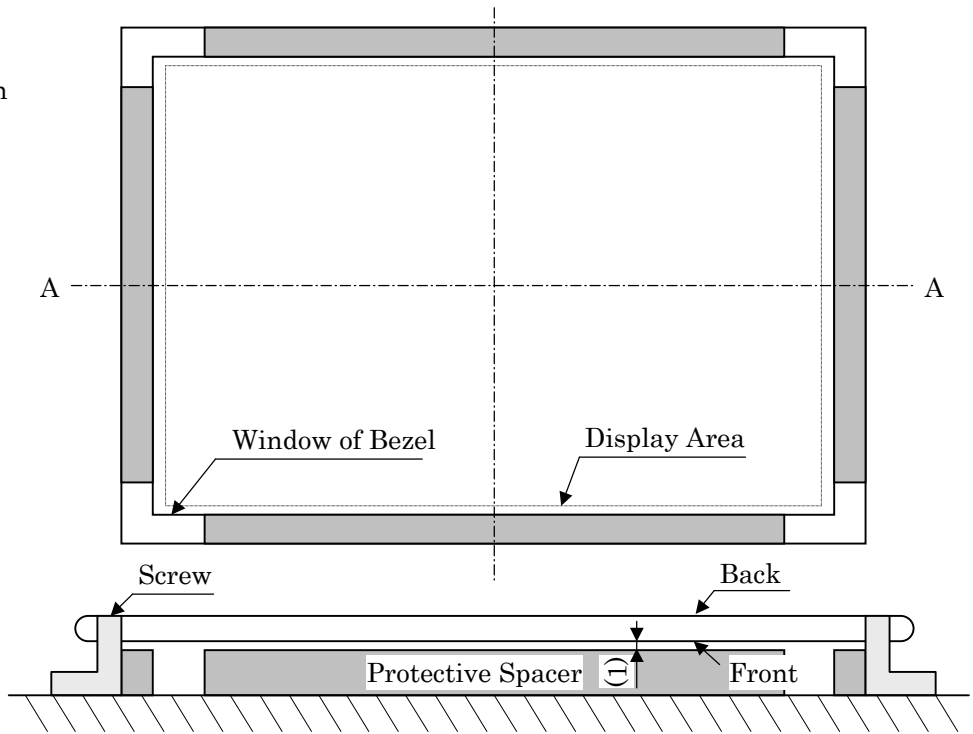
Metal frame of the module should be grounded with Customer's system ground in case that protection film is being peeled off while operating the module.

Unless you connected between metal frame and System Ground.

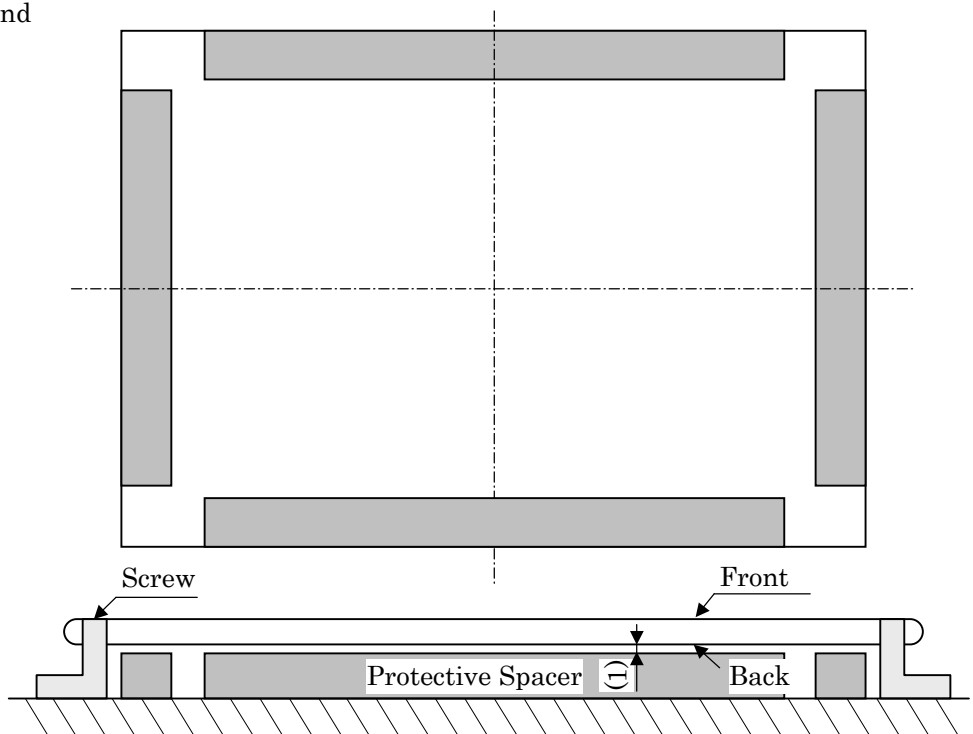
Machine's system happen to shut down due to the influence of electrostatic discharge caused by peeling off the protection film.

PROTECTIVE 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



2. OPTICAL CHARACTERISTICS

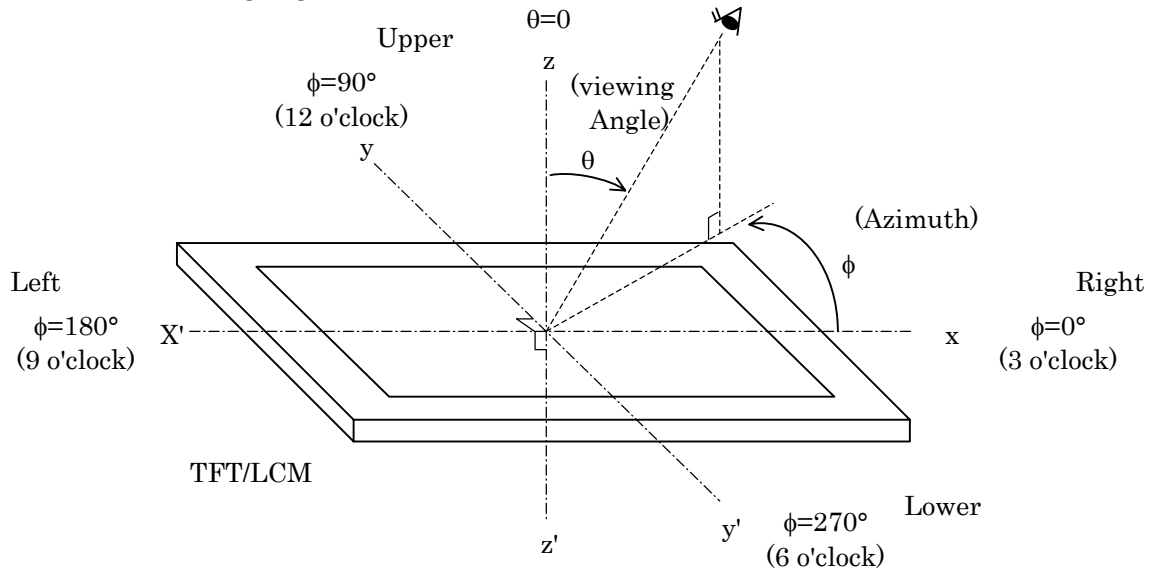
The following items are measured on the conditions that this unit operation (TFT panel and Back-light) and measuring systems are stable. (more than 30minutes' operation)
The ambient light excluding The Back-light unit is nothing.

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

Temperature of LCD=25°C±3°C, V_{DD}=3.3V, f_V=60Hz, f_L=50kHz, I_L=6mA_{rms}

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio	CR	θ=0° Note 1)	200	500	—	—	2)	
Response Time	Rise		tr	—	20	—	ms	3)
	Fall		tf	—	10	—		
Brightness (white)	Bwh		—	350	—	cd/m ²		
Color of CIE	Red		x	0.58	0.63	0.68	—	
			y	0.29	0.34	0.39		
	Green		x	0.25	0.30	0.35		
			y	0.55	0.60	0.65		
	Blue		x	0.09	0.14	0.19		
			y	0.04	0.09	0.14		
	White	x	0.27	0.32	0.37			
		y	0.28	0.33	0.38			
Viewing Angle (CR≥10)	x-x'	θ _x	φ = 0°	—	60	—	deg.	1)
		θ _{x'}	φ = 180°	—	60	—		
	y-y'	θ _y	φ = 90°	—	45	—		
		θ _{y'}	φ = 270°	—	50	—		

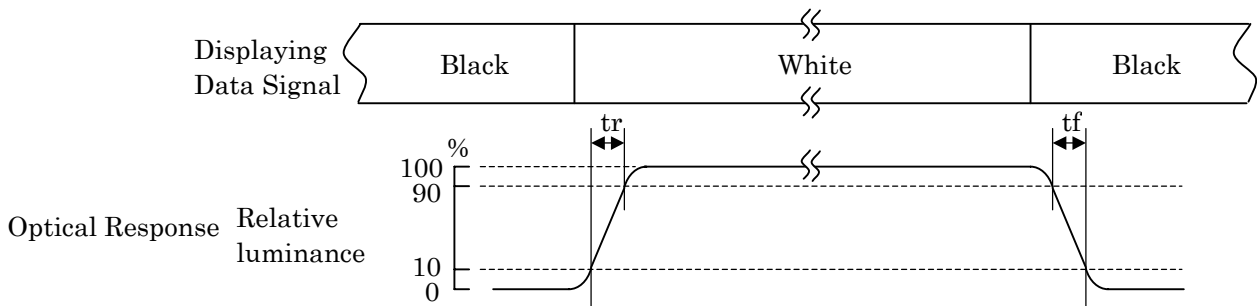
Notes 1) Definition of Viewing Angle



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



3. ELECTRICAL CHARACTERISTICS

3.1 TFT LIQUID CRYSTAL DISPLAY MODULE

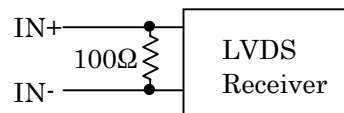
$T_a=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$

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}	–	0.4	0.65	A	2),3)
Vertical Frequency	f_V	–	60	65	Hz	4),5)
Horizontal Frequency	f_H	–	48.3	52.4	kHz	4)
DCLK Frequency	f_{CLK}	–	65	68	MHz	4)

Notes 1) $V_{CM}=+1.25\text{V}$

VCM is common mode voltage of LVDS transmitter/receiver.

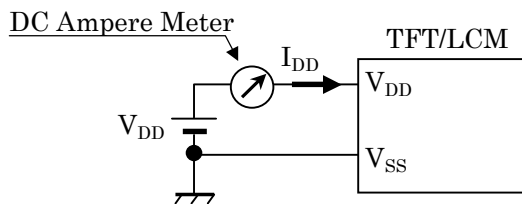
The input terminal of LVDS transmitter is terminated with 100Ω .



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

Typical value is measured when displaying vertical 256 gray scale.

Maximum is measured when displaying Vertical-stripe (Black-Gray 28).



3) As this module contains 1.0A fuse, prepare current source that is enough for cutting current fuse when a trouble happens. (larger than 2.5A.)

4) For LVDS Transmitter Input

5) Vertical Frequency is encouraged to be used by 60Hz.

The flicker level changes by the gap of the vertical frequency.

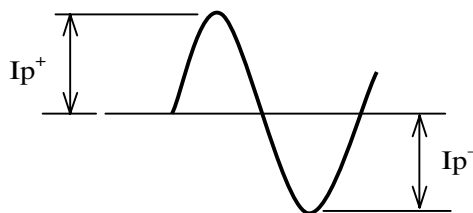
3.2 BACK-LIGHT UNIT

Ta=25°C, GND=0V

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Current	I_L	3.0	6.0	6.5	mArms	1),2)
Input Voltage	V_L	–	620	–	Vrms	7)
Frequency	f_L	40	–	70	kHz	3)
Starting Lamp Voltage	V_s	1170	–	–	Vrms	Ta=25°C 4),5)
		1370	–	–		Ta=-10°C 4),5)

Notes 1) I_L is Current of GND side.

- 2) Higher I_L 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 should be more than V_s (Min).
- 5) Inverter open output voltage please makes the design which 1 seconds or more can be continued at least. When it is below that, there are times when the lamp dose not light up.
- 6) Quality of the inverter produces big effect on illumination efficiency and life of back light. When it arranges the inverter, that back light and flicker etc. the illumination malfunction of back light does not occur, we request verification. In addition, as for verification as much as possible we recommend that it executes when it is close to the apparatus. In addition, as for the inverter, over voltage, use you ask those which have the safe protection circuit such as the over current inspection circuit and the discharge corrugated inspection circuit.
- 7) $I_L=6\text{mArms}$
- 8) Distribution difference of lamp surface temperature should be less than 5°C
- 9) When the lighting wave form of the inverter is asymmetry, the inclination of mercury is generated. Therefore, please adjust the unbalance ($|I_p^+ - I_p^-| / I_{rms} \times 100\%$) of the lighting current wave form to 10% or less, and adjust the wave high rate (I_p^+ (or I_p^-) / I_{rms}) to 1.2~1.63.

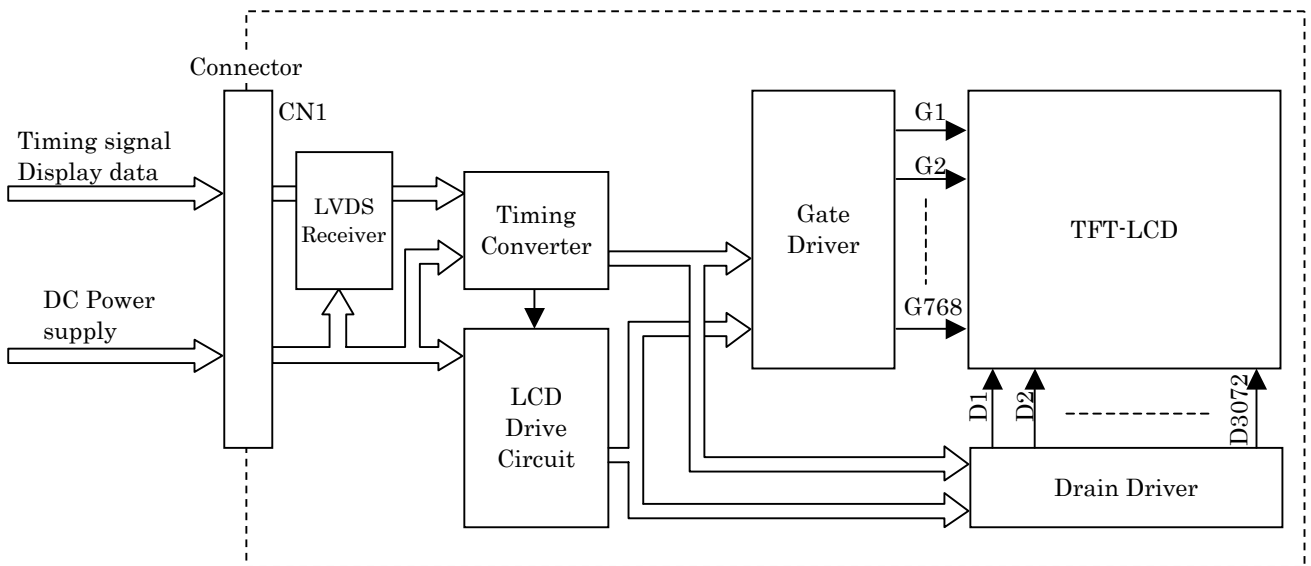


Inverter current wave form.

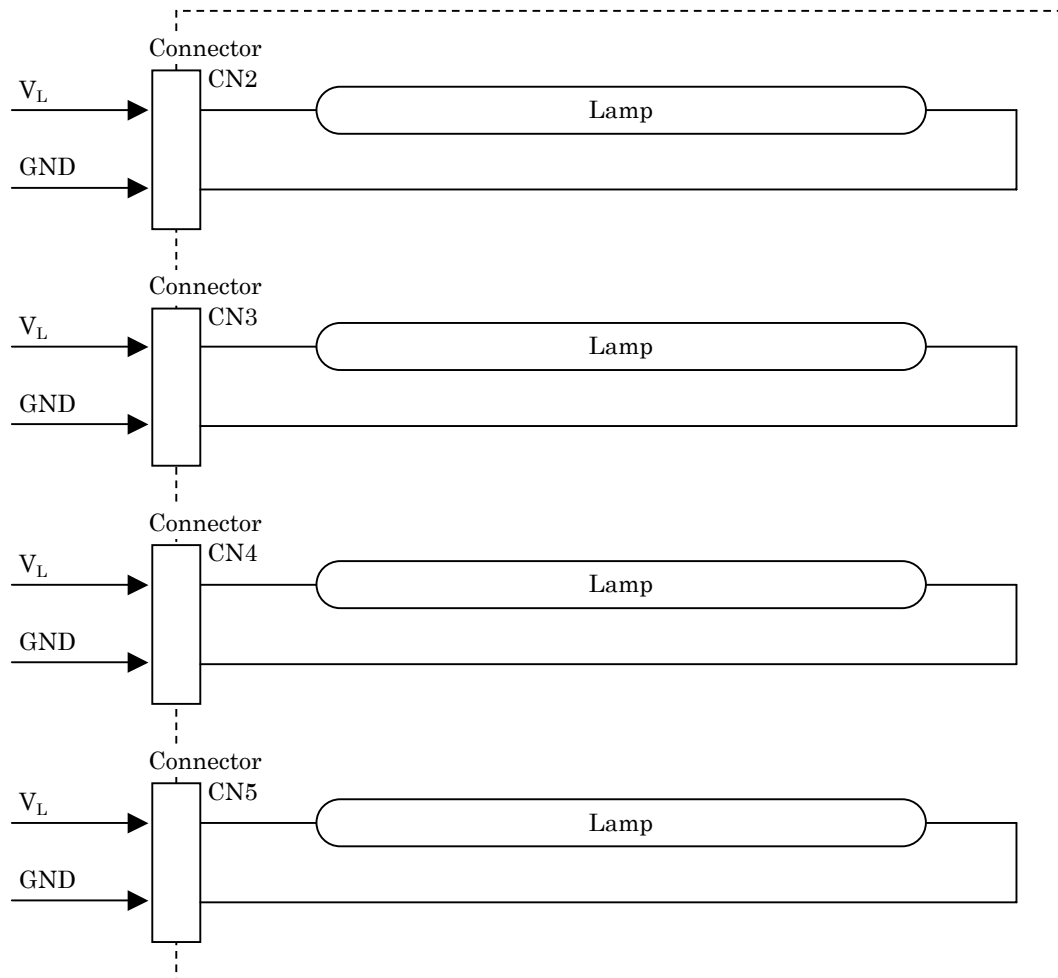
- 10) Recommendation inverter : HITACHI LIGHTING, Ltd.
Type name : INVC784 suitable item

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-HF13E>>

Pin No.	Symbol	Function	Note
1	VDD	Power Supply (3.3V)	1)
2			
3	V _{ss}	GND (0V)	2)
4			
5	IN0-	Pixel Data	
6	IN0+		
7	V _{ss}	GND (0V)	2)
8	IN1-	Pixel Data	
9	IN1+		
10	V _{ss}	GND (0V)	2)
11	IN2-	Pixel Data	
12	IN2+		
13	V _{ss}	GND (0V)	2)
14	CLK IN-	Clock	
15	CLK IN+		
16	V _{ss}	GND (0V)	2)
17	IN3-	Pixel Data	
18	IN3+		
19	V _{ss}	GND (0V)	2)
20	A Mode	Setup of LVDS	

Notes 1) All VDD pins should be connected to +3.3V.

2) All VSS pins should be connected to GND (0V).

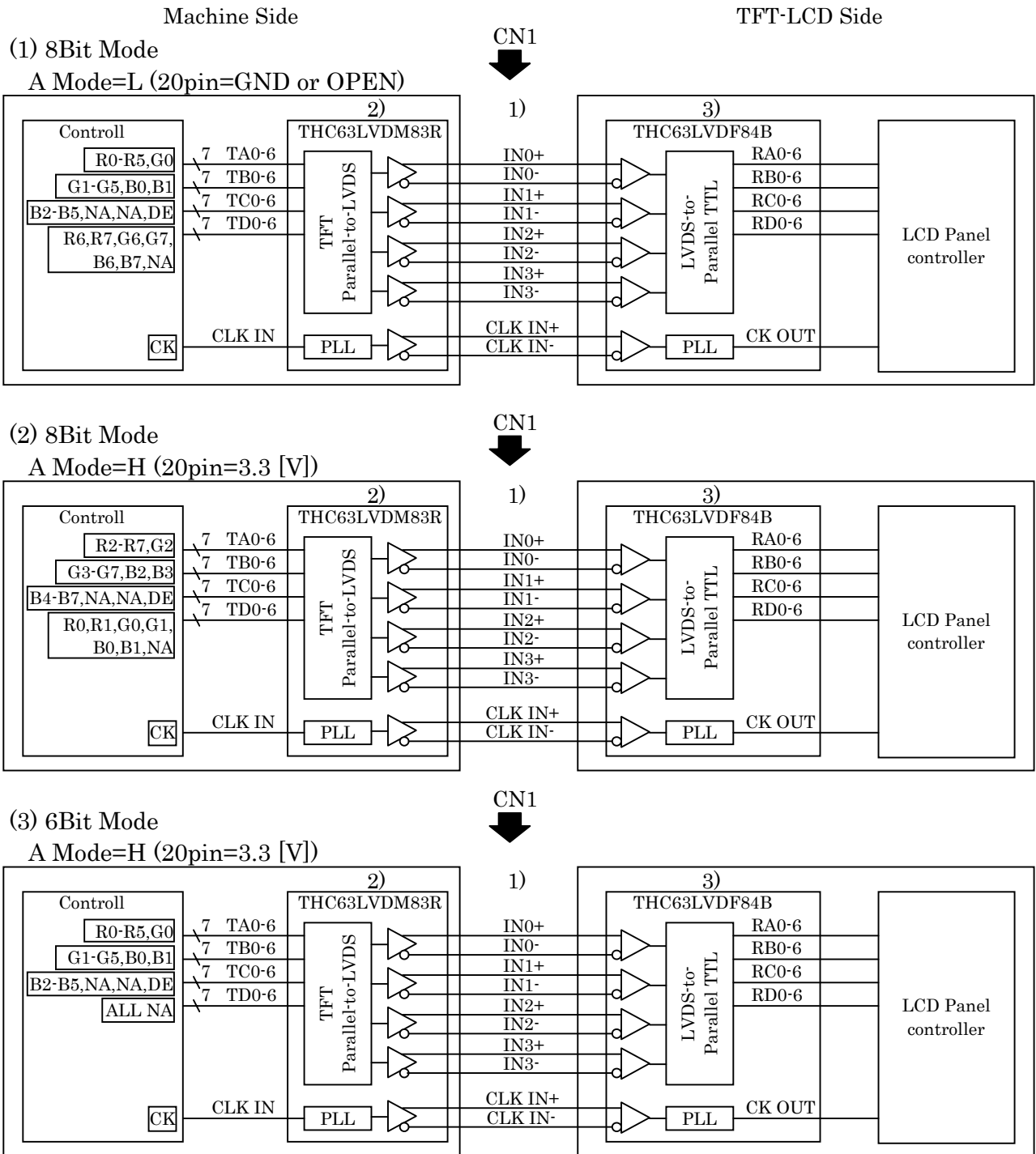
Metal bezel is connected internally to VSS.

5.2 BACK-LIGHT UNIT

CN2,CN3,CN4,CN5 <<JST BHSR-02VS-1>>

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

LVDS INTERFACE



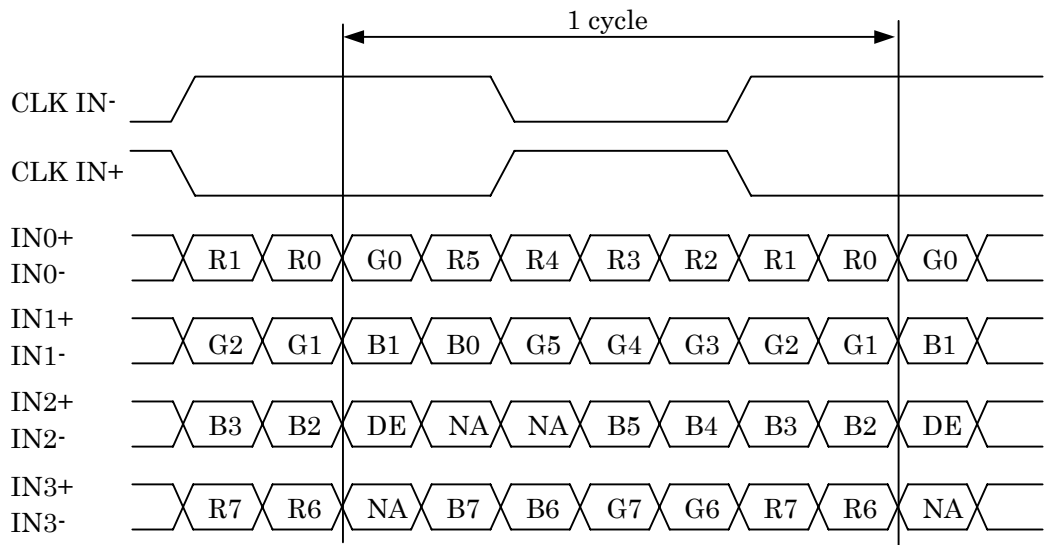
- Notes 1) We recommend 100Ω for characteristic impedance of LVDS cable between the differential signal lines.
When impedance is unmatched, Screen may not display correctly.
- 2) Transmitter • Made by THine: THC63LVDM83R equivalent.
Transmitter is not contained in Module.
- 3) Receiver • Made by THine: THC63LVDF84B equivalent.

DATA MAPPING

(1) 8 Bit Mode

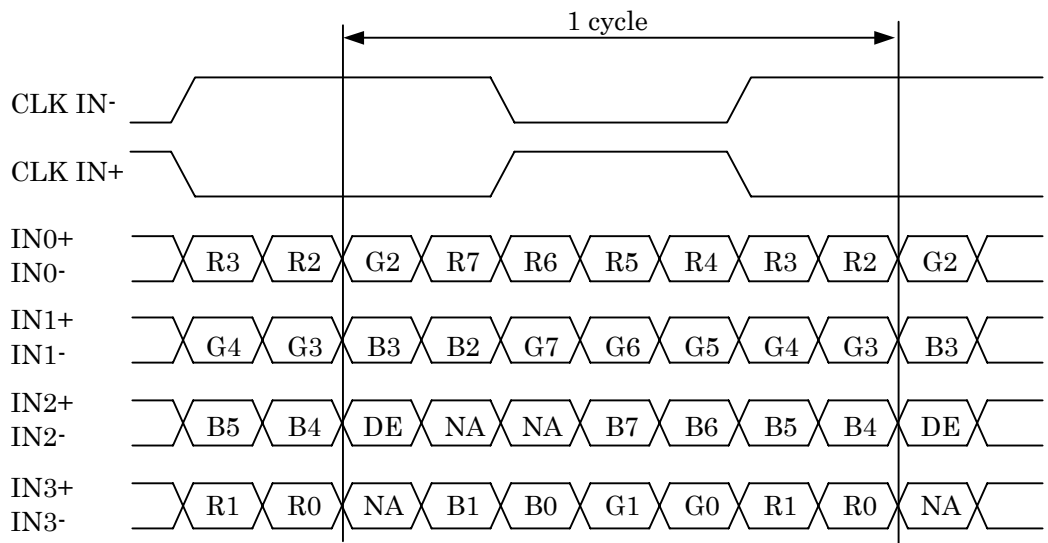
Note: Assignment in the A Mode (THC63LVDM83R)

Transmitter		20pin A Mode	
Pin No.	Data	=L (GND) or Open	=H (3.3V)
51	TA0	R0 (LSB)	R2
52	TA1	R1	R3
54	TA2	R2	R4
55	TA3	R3	R5
56	TA4	R4	R6
3	TA5	R5	R7 (MSB)
4	TA6	G0 (LSB)	G2
6	TB0	G1	G3
7	TB1	G2	G4
11	TB2	G3	G5
12	TB3	G4	G6
14	TB4	G5	G7 (MSB)
15	TB5	B0 (LSB)	B2
19	TB6	B1	B3
20	TC0	B2	B4
22	TC1	B3	B5
23	TC2	B4	B6
24	TC3	B5	B7 (MSB)
27	TC4	(NA)	(NA)
28	TC5	(NA)	(NA)
30	TC6	DE	DE
50	TD0	R6	R0 (LSB)
2	TD1	R7 (MSB)	R1
8	TD2	G6	G0 (LSB)
10	TD3	G7 (MSB)	G1
16	TD4	B6	B0 (LSB)
18	TD5	B7 (MSB)	B1
25	TD6	(NA)	(NA)



DE: Display Enable

NA: Not Available



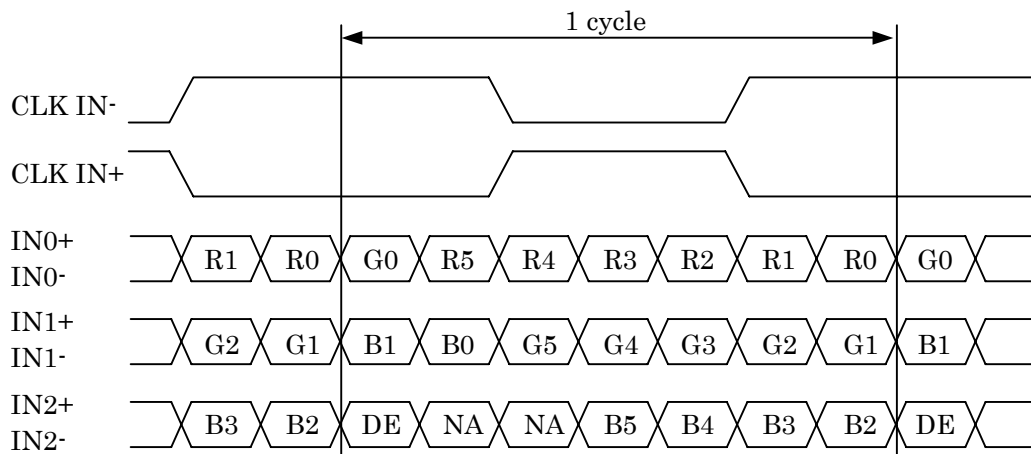
DE: Display Enable

NA: Not Available

(2) 6 Bit Mode

Note: Assignment in the A Mode (THC63LVDM83R)

Transmitter		A Mode	
Pin No.	Data	=L (GND) or Open	=H (3.3V)
51	TA0	–	R0 (LSB)
52	TA1	–	R1
54	TA2	–	R2
55	TA3	–	R3
56	TA4	–	R4
3	TA5	–	R5 (MSB)
4	TA6	–	G0 (LSB)
6	TB0	–	G1
7	TB1	–	G2
11	TB2	–	G3
12	TB3	–	G4
14	TB4	–	G5 (MSB)
15	TB5	–	B0 (LSB)
19	TB6	–	B1
20	TC0	–	B2
22	TC1	–	B3
23	TC2	–	B4
24	TC3	–	B5 (MSB)
27	TC4	–	(NA)
28	TC5	–	(NA)
30	TC6	–	DE
50	TD0	–	GND
2	TD1	–	GND
8	TD2	–	GND
10	TD3	–	GND
16	TD4	–	GND
18	TD5	–	GND
25	TD6	–	(NA)



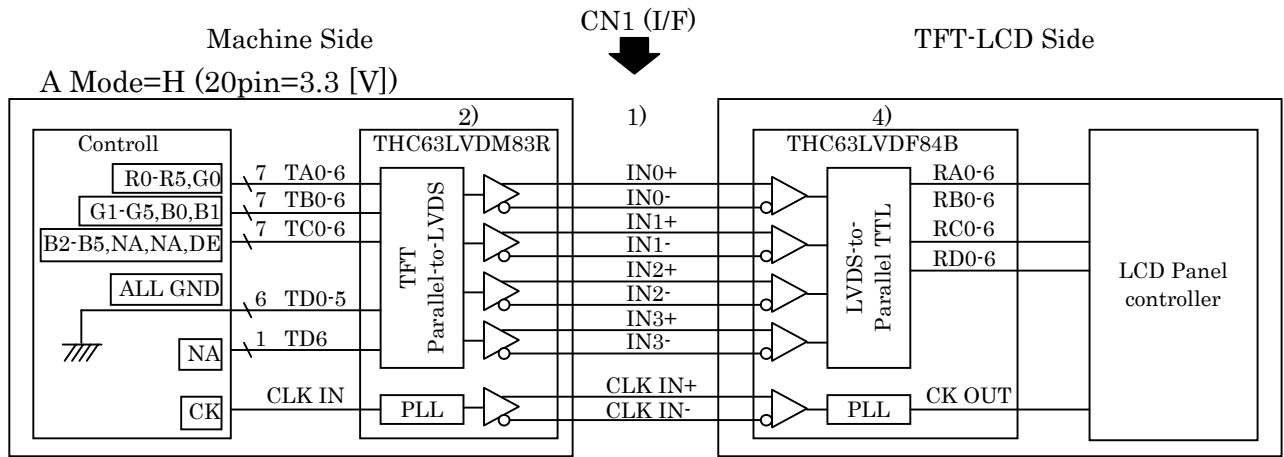
DE: Display Enable

NA: Not Available

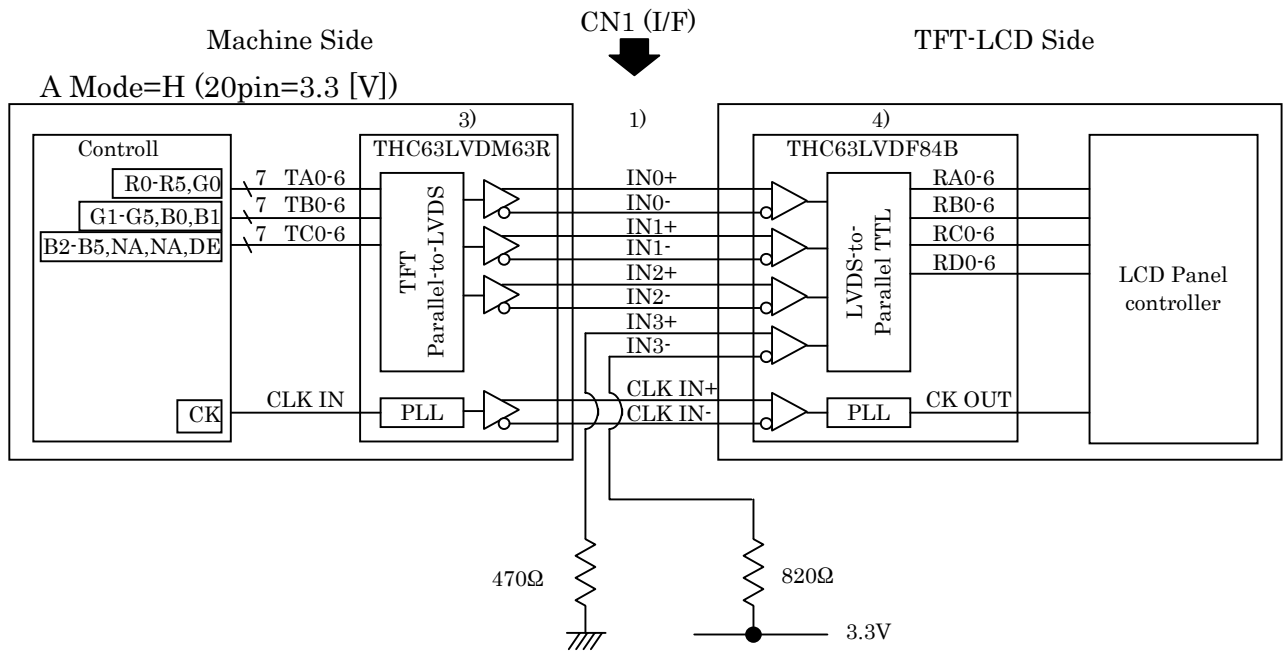
HOW TO USE IN3-, IN3+ PINS WHEN AT 6 BIT INPUT

Either operation is necessary

(1) TD0~TD5 should be connected to GND.



(2) No.17 pin of CN1 (IN3-) should be connected 820Ω resistor in series to 3.3V (Pull-up), No.18 pin (IN3+) should be connected 470Ω in series to GND (Pull-down). Do not leave No.17 & No.18 pin of CN1 open.



- Notes 1) We recommend 100Ω for characteristic impedance of LVDS cable between the differential signal lines. When impedance is unmatched, Screen may not display correctly.
- 2) Transmitter • Made by THine: THC63LVDM83R equivalent.
- 3) Transmitter • Made by THine: THC63LVDM63R equivalent. Transmitter is not contained in Module.
- 4) Receiver • Made by THine: THC63LVDF84B equivalent.

RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT DATA (6 Bit Mode)

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 (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	1	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	1	0	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

RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT DATA (8 Bit Mode)

Input data Color		R Data								G Data								B Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Red (253)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Green (253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	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	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	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	0	0	0	0	0	0	1	1
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Blue (253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
	Blue (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Notes 1) Definition of gray scale :

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

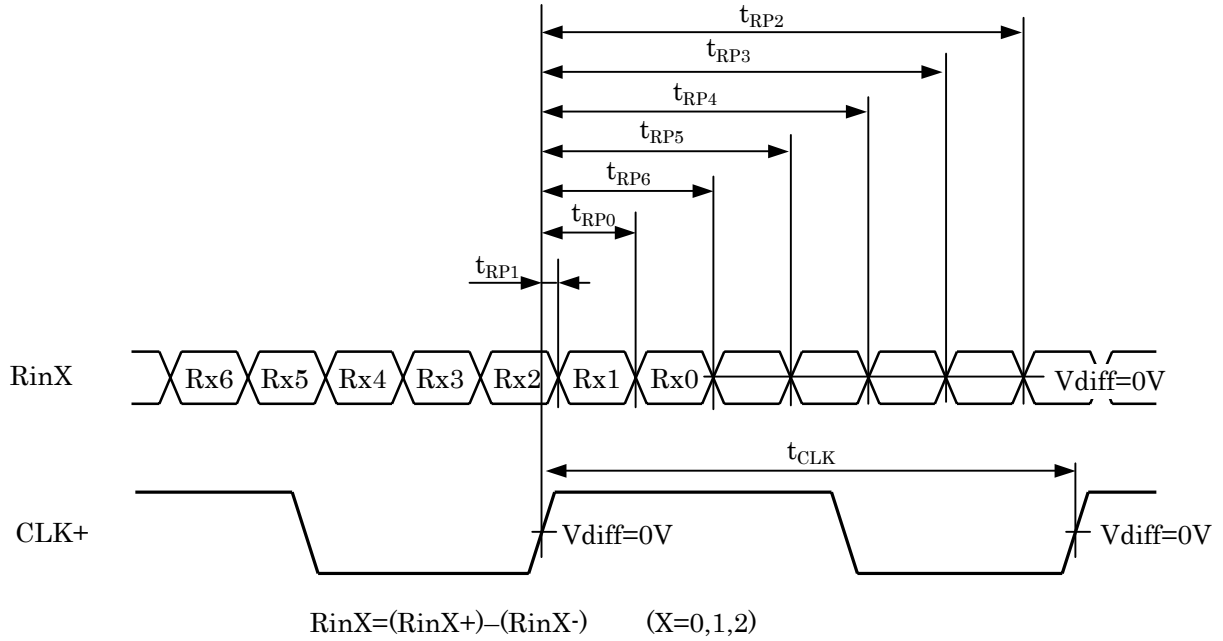
Larger number corresponds to brighter level.

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

6. INTERFACE TIMING

6.1 LVDS RECEIVER TIMING

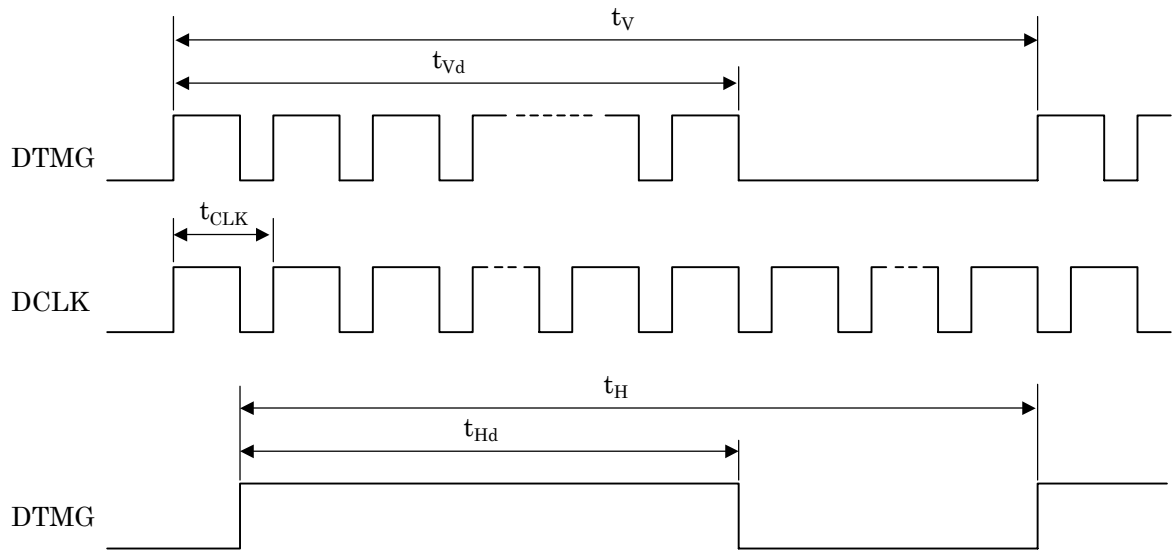
(Interface of TFT module)



Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	FREQUENCY	$1/t_{CLK}$	60	65	68	MHz
RinX (X=0,1,2,3)	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}	$2/7t_{CLK}-0.49$	$2/7t_{CLK}$	$2/7t_{CLK}+0.49$	

6.2 TIMING CONVERTER TIMING

(Input timing for transmitter)



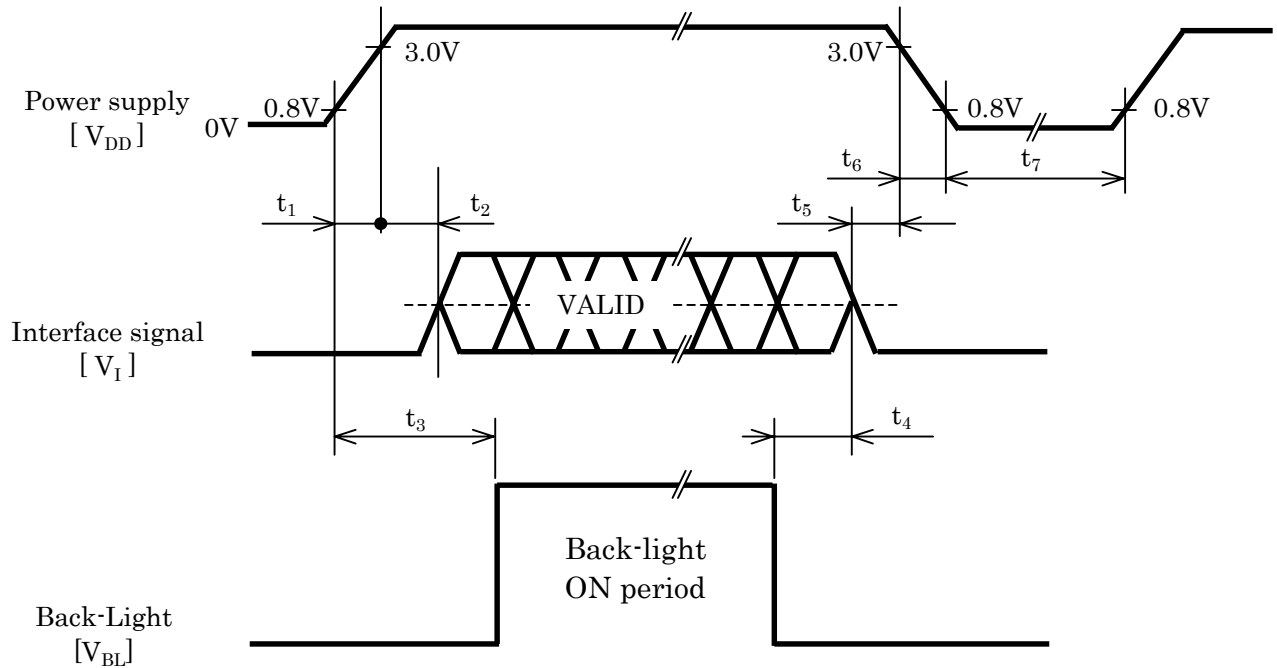
The timings except mentioned above are refer to the specifications of your transmitter.

Item		Symbol	Min.	Typ.	Max.	Unit
DCLK	Cycle time	t_{CLK}	14.8	15.4	–	ns
DTMG	Line cycle time	t_H	1,180	1,344	2,400	t_{CLK}
	Line width-Active	t_{Hd}	1,024	1,024	1,024	
	Frame cycle time ¹⁾	t_V	771	806	1,000	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 Supply, Input Signal and Backlight Voltage ON/OFF/REENTRY should comply with the following sequence.



POWER ON
 $0 < t_1 \leq 15\text{ms}$
 $0 < t_2 \leq 45\text{ms}$
 $100\text{ms} < t_3$

POWER OFF
 $5\text{ms} \leq t_4$
 $0 \leq t_5 \leq 45\text{ms}$
 $0 \leq t_6 \leq 20\text{ms}$
 $500\text{ms} \leq t_7$

Notes 1) In order to prevent electronic parts from destruction caused by latch-up, please input signal after Power Supply Voltage ON.

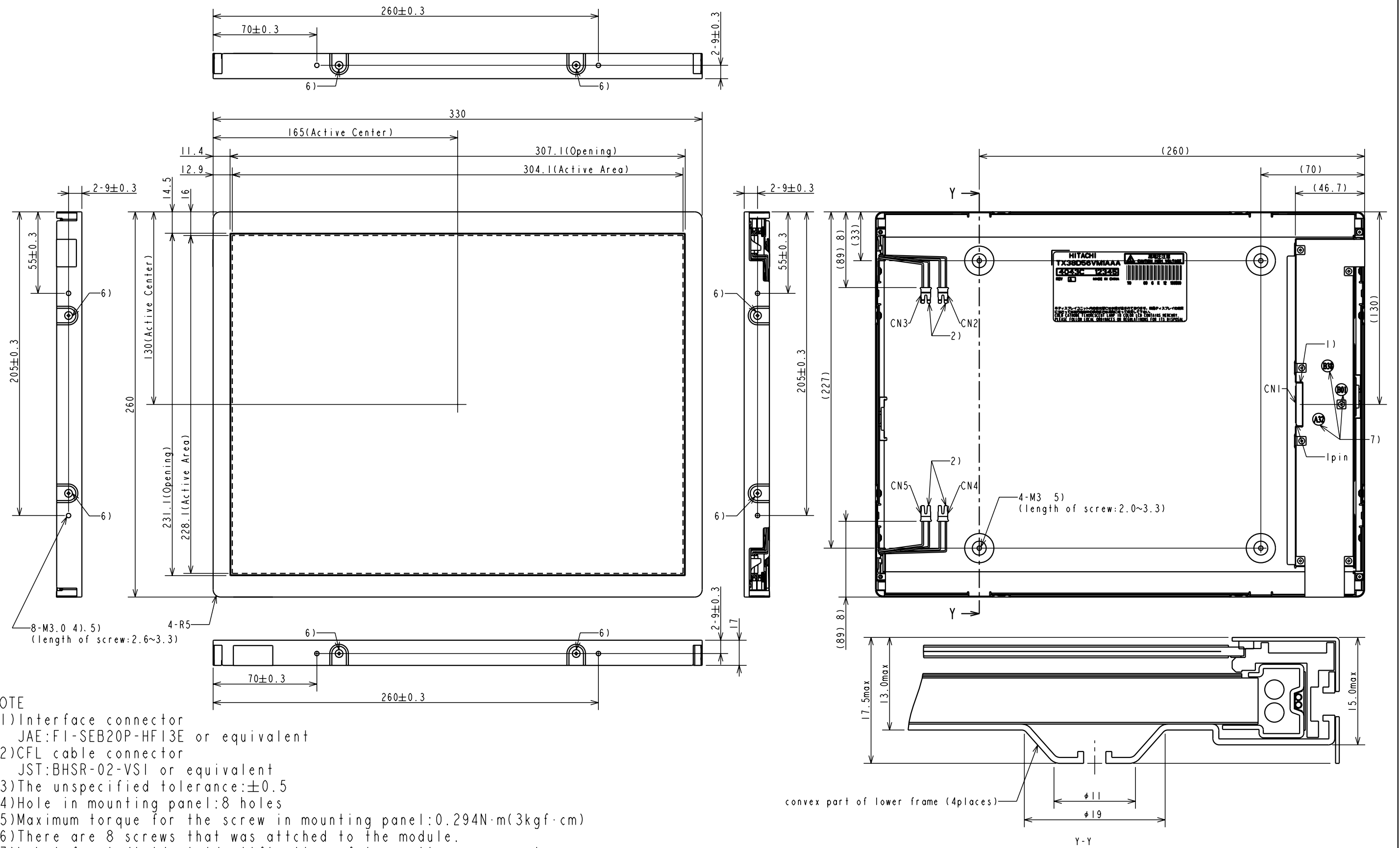
In addition, please turn off signals before Power Supply Voltage OFF.

2) In order to prevent from function error due to residual charge, please reenter Power Supply Voltage after time stipulated with t₇.

3) Please turn on Backlight after signals fix and turn off before signals down, otherwise noise appears in the display.

The noise cause no problem with display performance in case of timing sequence comply with the spec.

7. DIMENSIONAL OUTLINE



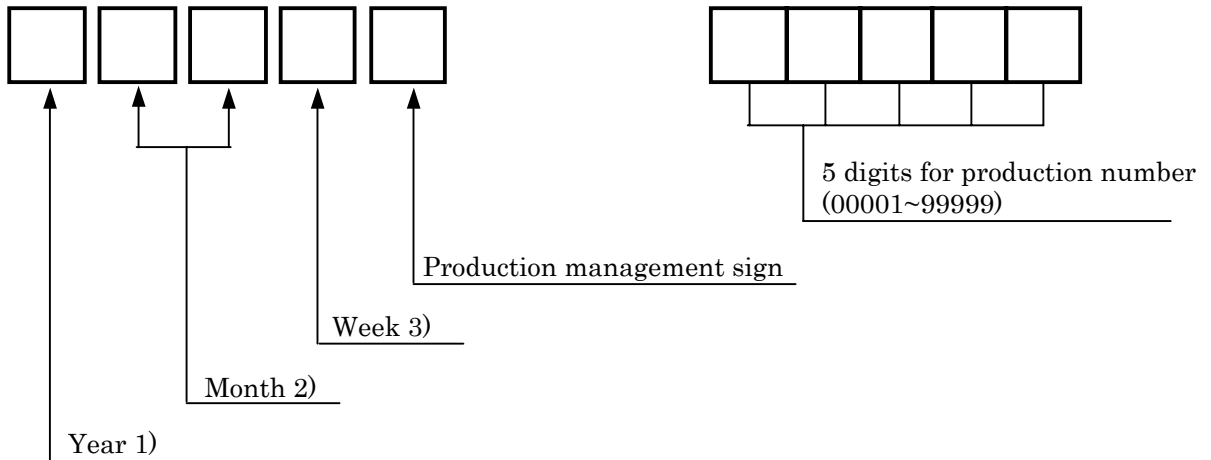
NOTE

- 1) Interface connector
JAE:FI-SEB20P-HF13E or equivalent
- 2) CFL cable connector
JST:BHSR-02-VS1 or equivalent
- 3) The unspecified tolerance:±0.5
- 4) Hole in mounting panel:8 holes
- 5) Maximum torque for the screw in mounting panel:0.294N·m(3kgf·cm)
- 6) There are 8 screws that was attached to the module.
- 7) Label for individual identification of inspection personnel.
The character of the label might be different in each product.
- 8) Size when CFL cable is extended straight.

UNIT:mm

8. DESIGNATION OF LOT MARK

8.1 LOT MARK



Notes

1)

Year	Mark
2008	8
2009	9
2010	0
2010	1
2011	2

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)

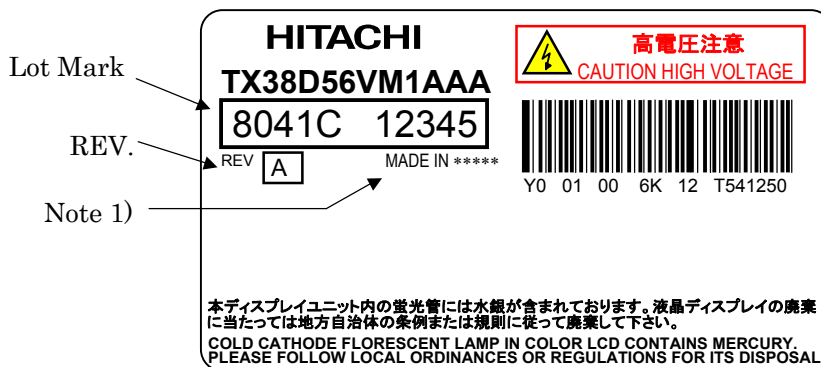
Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

8.2 REVISION (REV.) CONTROL

REV. is the column for manufacturing convenience. A-Z except I and O may be written on this column.

8.3 LOCATION OF LOT MARK

Lot mark is printed on a label. The label sticks on back of TFT module. The style of character will be changed without notice.



Note 1) Indication of place of origin (*****section)

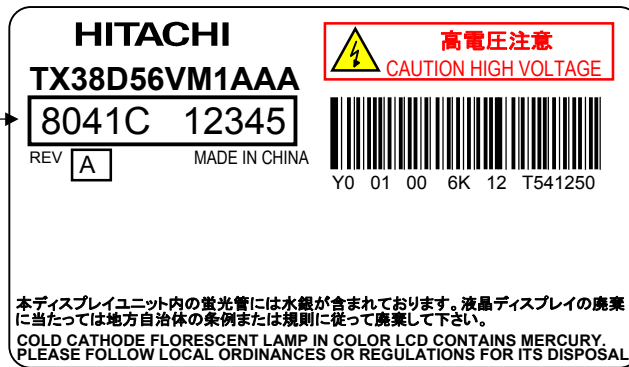
CHINA
JAPAN
TAIWAN

8.4 LOCATION OF LOT MARK

Label is attached on the back side of module.
The items mentioned change without notice.

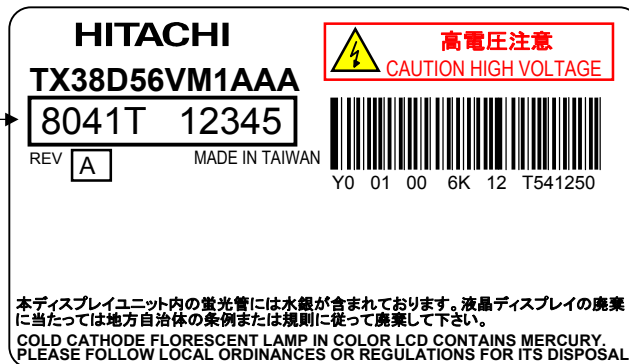
8.4.1 MADE IN CHINA

Lot No. &
Production Control No.



8.4.2 MADE IN TAIWAN

Lot No. &
Production Control No.



8.4.3 MADE IN JAPAN

Lot No. &
Production Control No.

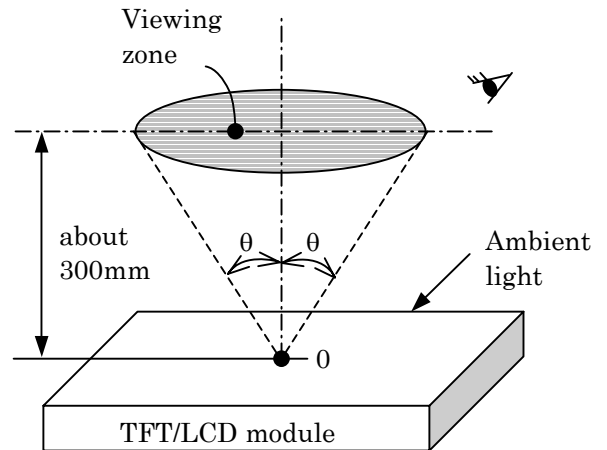


9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

- i) The figure shows the correspondence between eyes (of inspector) and TFT/LCD module.
 - $\theta \leq 15^\circ$ 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)



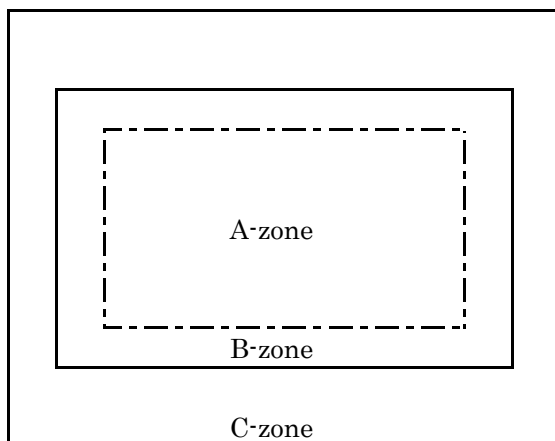
(2) Environmental

- i) Temperature : 25°C
When operating inspection, surface temperature of LCD panel is 25°C .
- ii) Ambient light : 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 Interface 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)
			2dots	2	units	1), 2), 5)
			3dots	0		
			4dots	0		
			Density	2	pcs ϕ 15mm	1), 2), 6)
		Total	5	pcs	1), 2)	
		Black mode	1dot	10	pcs	1), 3) 4)
			2dots	5	units	1), 3), 5)
			3dots	0		
			4dots	0		
	Density		3	pcs ϕ 5mm	1), 3), 7)	
	Total	10	pcs	1), 3)		
	Total	15	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 0.06	L: Ignore	Ignore	pcs	8)
		W > 0.06	L > 1.0	By Dot shape		
			L \leq 1.0	Ignore		
5	Stain Inclusion (Dot shape D: average dia.(mm))	D \leq 0.45		Ignore	pcs	8)
		D \leq 0.7		5		
		D > 0.7		0		
6	Scratch on polarizer (Line shape W: width (mm) L: length (mm))	W \leq 0.01	L: Ignore	Ignore	pcs	9)
		W \leq 0.02	L \leq 40	10		
			L > 40	0		
		W \leq 0.04	L \leq 20	10		
			L > 20	0		
7	Scratch on polarizer (Dot shape D: average dia.(mm))	D \leq 0.45		Ignore	pcs	9)
		D \leq 0.7		10		
		D > 0.7		0		

No.	Item	Maximum acceptable number		Note
		A-zone	Unit	
8	Bubbles, peeling of polarizer [D: average dia.(mm)]	D ≤ 1.0	Ignore	pcs 9)
		D ≤ 2.0	10	
		D > 2.0	0	
9	Wrinkles on Polarizer		Serious one is no good.	-
10	Burr of Polarizer edge	L ≤ 1.0	Ignore	pcs
		L > 1.0	0	

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) Dense Dot Defect of Sparkle mode : the number of defects in the area of φ 15mm.

7) Dense Dot Defect of Black mode : the number of defects in the area of φ 5mm.

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

9) Polarizer area inside of A-zone is applied, and B/C-zone is not applied.

10. PRECAUTION

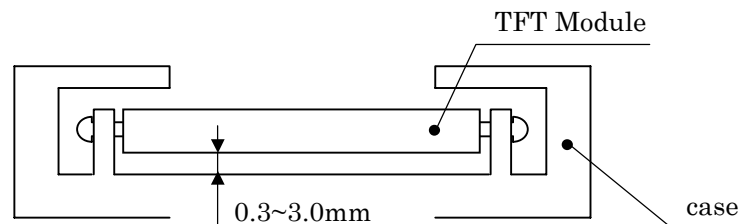
Please pay attention to the followings when you use this TFT/LCD module with Back-light unit.

10.1 MOUNTING PRECAUTION

- (1) You must mount Module using mounting holes arranged in 8 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 0.3~3.0mm.



- (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.

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).
In addition, it causes CFL life to shorten.
- (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 Interface 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 PRECAUTION TO STORAGE

When modules for replacement are stored for a long time, following precautions should be taken care of:

- (1) For preventing the liquid crystal deterioration with the ultraviolet ray, please retain when by all means it is inserted in the Hitachi shipping box.
- (2) When it cannot retain in the Hitachi shipping box, Modules should be stored in a dark place.
It is prohibited to apply sunlight or fluorescent light during storage.
- (3) The surface of polarizers should not come in contact with any other object.
It is recommended that modules should be stored in the Hitachi shipping box.
- (4) Modules should be at 5 to 35 at normal humidity (60%RH or less).
- (5) Please follow to the environmental condition of statement in the page 4-1/3 of CAS excluding the long term storage.

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.

10.8 ENVIRONMENTAL CONSERVATION

- (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) Printed circuits board used in a module contain small amount of lead below RoHS regulation value.
Please follow local ordinance or regulations for its disposal.