HITACHI

Hitachi Displays, Ltd.

Date; February 12, 2009

For _____

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX43D55VM0BAA

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

Accepted by : _____ Proposed by: H. Kawamura

Date : _____

DPATL000069400002YH

RECORD OF REVISION

Date	The upper section : Before revision The lower section : After revision		Summary
	Sheet No.	Page	
Feb. 12, 2009	3284PS2613-TX43D55VM0BAA-1	13-3/4	Corrected typo: 10.6 (1)
	3284PS2613-TX43D55VM0BAA-2	13-3/4	
	3284PS2613-TX43D55VM0BAA-1	13-4/4	Corrected a sentence: 10.10 OTHERS
	3284PS2613-TX43D55VM0BAA-2	13-4/4	

DESCRIPTION

The following specifications are applied to the following IPS-Pro-TFT module.

Note : Inverter for back light unit is not built in this module.

GENERAL SPECIFICATIONS

Part Name	: TX43D55VM0BAA
Effective Display Area	: H369.60 × V221.76 [mm]
Number of Pixels	: H1280 × V768 [pixels]
Pixel Pitch	: H0.28875 × V0.28875 [mm]
Color Pixel Arrangement	: R+G+B Vertical Stripe
Display Mode	: Transmissive Mode Normally Black Mode
Top Polarizer Type	: Anti-glare
Number of Colors	: 16,777,216 colors
Color Reproducibility	: NTSC-Ratio 60%
Viewing Angle Range	: Super Wide Version (Horizontal & Vertical : 170°, CR ≥ 10)
Input Signal	: 1-channel LVDS (LVDS: Low Voltage Differential Signaling)
Back Light	: 4 pcs. of CCFL
External Dimensions	: H400 × V258 × t22.0 [mm]
Weight	: 2200 [g]

・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.		
Temperature	-10	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)		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 LCD surface of a TFT module, not to the system installed with a module.
Function of module is guaranteed in above operating temperature range, but optical characteristics is specified for only 25°C operating condition.
The brightness of a CCFL tends to drop at low temperature. Besides, the life-time becomes shorter at low temperature.

2) Ta ≤ 40°C ..... Relative humidity should be less than 85%RH max. Dew is prohibited.
Ta > 40°C ..... Relative humidity should be lower than the moisture of the 85%RH at 40°C.

3) Frequency of the vibration is between 15Hz and 50Hz. (Remove the resonance point)

4) Pulse width of the shock is 3 ms.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT Module Vss=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	0	6.5	V	—
Differential signal input voltage	V_{IL}	0	3.4	V	1)
Input Voltage for logic	V_I	-0.3	5.0	V	2)
Electrostatic Durability	V_{ESD0}	±100		V	3),5)
	V_{ESD1}	±15		kV	4),6)

Notes 1) It is applied to LVDS signal.
2) It is applied to except LVDS signal.
3) Discharge Coefficient: 200pF-0Ω, Environmental: 25°C-70%RH
4) Discharge Coefficient: 200pF-250Ω, Environmental: 25°C-70%RH
5) It is applied to I/F connector pins.
6) It is applied to the surface of a metallic bezel and a LCD panel.

(2) Back Light GND=0V

ITEM	SYMBOL	Min.	Max.	Unit	Note
Input Current	I_L	—	7.0	mArms	1)
Input Voltage	V_L	—	1,500	Vrms	2)

Notes 1) The specification shall be applied each CCFL. The specification is defined at ground line.
2) The specification shall be applied connector pins for a CCFL at start-UP.

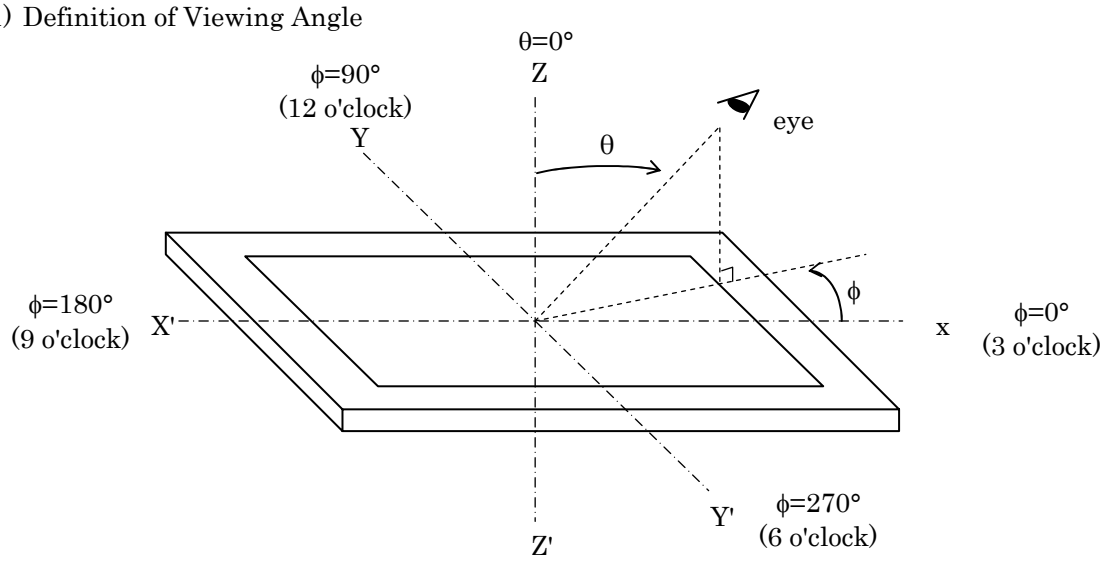
2. OPTICAL CHARACTERISTICS

The following optical characteristics are measured when the LCD is set alone (apart from driving circuits and monitor cabinets) and under stable conditions. It takes about 30 minutes to reach stable conditions. The measuring point is the center of display area otherwise noted.
The optical characteristics should be measured in a dark room or equivalent state.

Measuring equipment: KONICA MINOLTA:CS-1000, or equivalent.
Temperature of LCD surface=25°C, V_{DD}=5.0V, f_V=60Hz,
I_L=6.0mA (average or 4 pieces CCFLs. PWM Duty 100%)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ = 0° 1)	600	800	—	—	2)
Response Time	Rise	ton		—	10	25	ms	3)
	Fall	toff		—	12	25		
Brightness of white		Bwh		290	350	—	cd/m^2	—
Brightness uniformity		Buni		75	—	—	%	4)
Color Chromaticity (CIE)	Red	x		0.61	0.64	0.67	—	(Gray scale =255)
		y		0.31	0.34	0.37		
	Green	x		0.27	0.30	0.33		
		y		0.56	0.59	0.62		
	Blue	x		0.11	0.14	0.17		
		y		0.07	0.10	0.13		
	White	x		0.28	0.31	0.34		
		y		0.30	0.33	0.36		

Notes 1) Definition of Viewing Angle

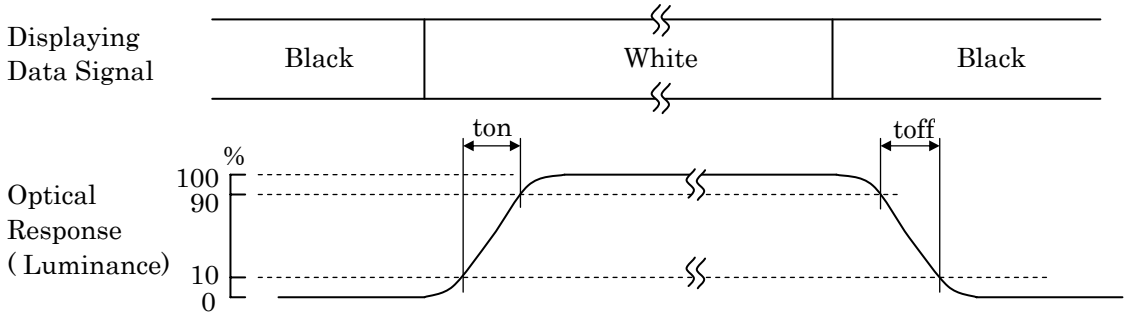


TFT Module

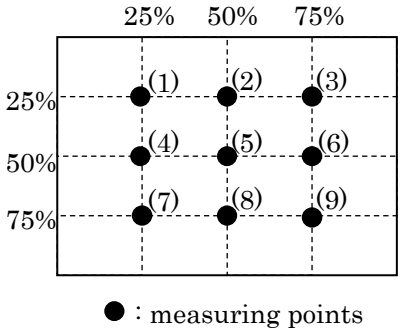
2) Definition of Contrast Ratio

$$CR = \frac{\text{(Luminance at displaying WHITE)}}{\text{(Luminance at displaying BLACK)}}$$

3) Definition of Response Time



4) Definition of Brightness Uniformity



Display pattern is white (255 level). The brightness uniformity is defined as the following equation. Brightness at each point is measured, and average, maximum and minimum brightness is calculated.

$$Buni = \left(\frac{Bmin}{Bmax} \right) \times 100$$

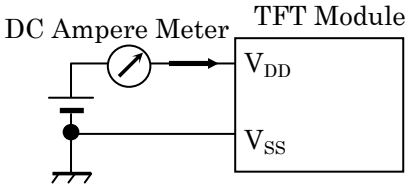
where, Bmax = Maximum brightness
Bmin = Minimum brightness

3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD MODULE — Ta=25°C, V_{SS}=0V

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		V_{DD}	4.5	5.0	5.5	V	—
Power Supply Current		I_{DD}	—	0.65	0.85	A	1),2),3)
Differential Input Voltage	High	V_{IH}	—	—	+100	mV	VCM=1.2V
For LVDS Receiver Threshold	Low	V_{IL}	-100	—	—	mV	VCM=1.2V
Frame Frequency		f_V	55	60	65	Hz	4)
One line scanning Frequency		f_H	44.8	47.1	52.3	kHz	4)
DCLK Frequency		f_{CLK}	65	66	73	MHz	4)

Notes 1) DC current at f_V=60Hz, f_{CLK}=66MHz and V_{DD}=5.0V



2) As this module contains fuse (1.6A), prepare current source that is enough for cutting current fuse (larger than 4.0A) or set a protection circuit when a trouble happens.
3) The picture on maximum current is white picture.
4) When at low frequency drive, flicker may appear on screen. Therefore, please verify the flicker level before system design.

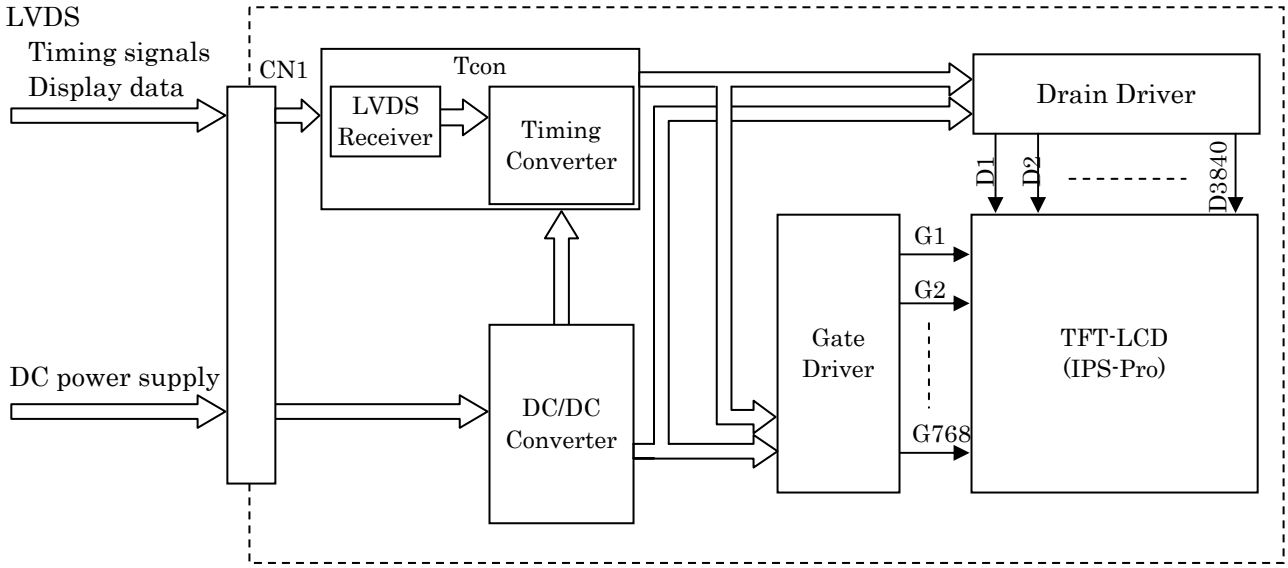
3.2 BACK LIGHT — Ta=25°C, V_{SS}=0V

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	3.0	6.0	6.5	mArms	1),2)
Lamp Voltage	V_L	—	770	—	Vrms	—
Lighting Frequency	f_L	40	—	80	kHz	3)
Starting Lamp Voltage	V_S	1,320	—	—	Vrms	4),5)

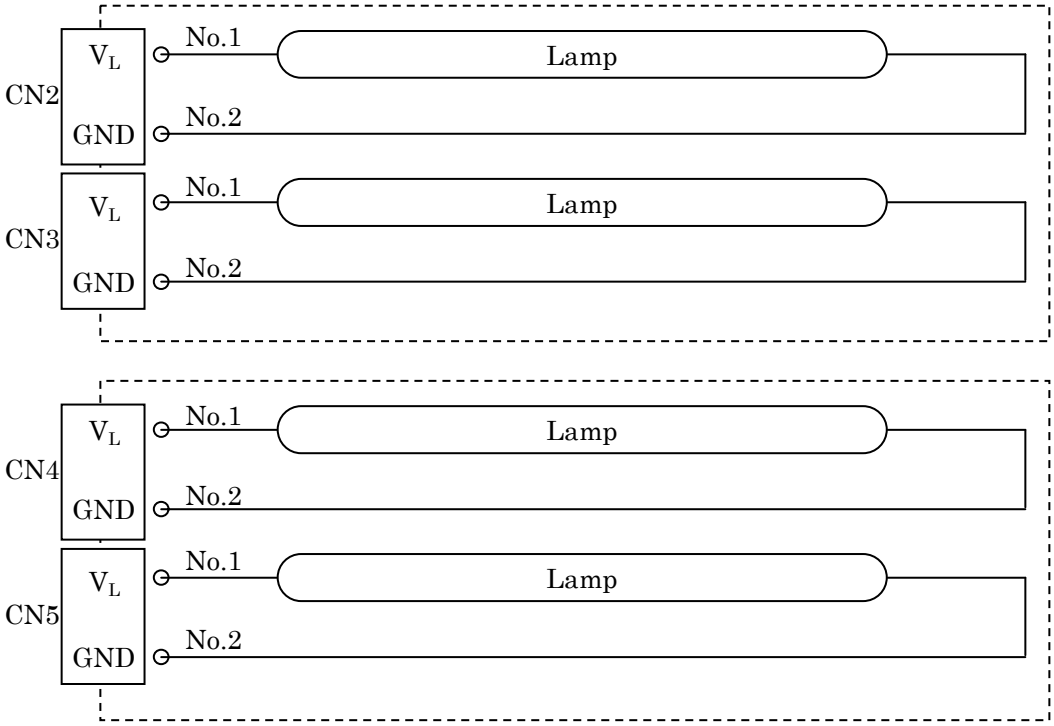
Notes 1) The specification shall be applied to each CCFL. The specification is defined at ground line.
2) Higher I_L cause the short life time of CCFL.
3) Lighting frequency for a CCFL may cause the interference with scanning frequency and cause beat or flicker on the display. Therefore, Lighting frequency 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 ($|I_P-I_{-P}|/I_{rms}\times100$) of the lighting current wave form to 10% or less, and adjust the crest factor (I_P (or I_{-P})/I_{rms}) to 1.2~1.6.
8) The lighting wave form of the inverter is in-phase in a lamp unit.
9) Recommendation inverter : Hitachi Lighting, Ltd.
Type name : INVC784 suitable item.

4. BLOCK DIAGRAM

(1) TFT Module



(2) Back light unit



5. INTERFACE PIN ASSIGNMENT

5.1 TFT-LCD MODULE

CN1 <<JAE: FI-X30SSL-HF (Matching connector: JAE FI-X30HL or FI-X30C2L-NPB)>>

Pin No.	Symbol	Function	Note
1	VDD	Power Supply (+5.0V)	4)
2	VDD		
3	VDD		
4	VDD		
5	VSS	GND (0V)	1)
6	VSS		
7	VSS		
8	VSS		
9	TEST1	Test Pin (OPEN)	3)
10	TEST2	Test Pin (OPEN)	3)
11	VSS	GND (0V)	1)
12	RX0-	Pixel Data	2)
13	RX0+		
14	VSS	GND (0V)	1)
15	RX1-	Pixel Data	2)
16	RX1+		
17	VSS	GND (0V)	1)
18	RX2-	Pixel Data	2)
19	RX2+		
20	VSS	GND (0V)	1)
21	CLK-	Pixel Clock	2)
22	CLK+		
23	VSS	GND (0V)	1)
24	RX3-	Pixel Data	2)
25	RX3+		
26	VSS	GND (0V)	1)
27	AMODE	LVDS Mode Select	5)
28	TEST3	Test Pin (OPEN)	3)
29	TEST4	Test Pin (OPEN)	3)
30	VSS	GND (0V)	1)

Notes 1) All Vss pins should be grounded.

2) RXn- and RXn+ (n=0,1,2,3), CLK- and CLK+ should be wired by twist-pairs or side-by-side FPC patterns, respectively.

3) Please keep open. HITACHI test only.

4) All V_{DD} pins should be connected to +5.0 V (typ.).

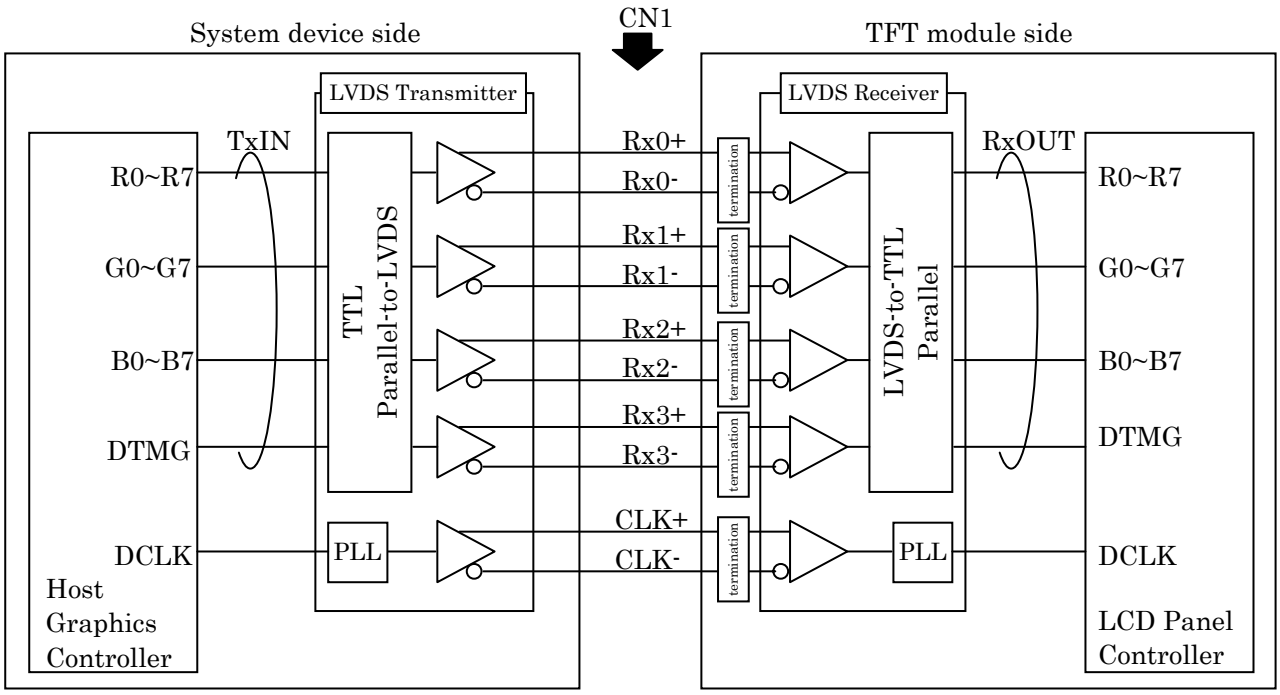
5) Please refer to page 8-4/6 "LVDS interface" for LVDS data mapping.

5.2 BACK-LIGHT UNIT

CN2,CN3,CN4,CN5 <<JST: BHSR-02VS-1(Matching connector: JST SM02B-BHSS-1)>>

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

BLOCK DIAGRAM OF INTERFACE



Receiver: Equivalent of THC63LVDF84B by THine

R0~7 : R data
G0~7 : G data
B0~7 : B data
DTMG : Display timing data

Notes 1) The system must have a LVDS transmitter to drive a module.
2) The impedance of LVDS cable shall be about 100 ohms per twist-pair line when it is used differentially.

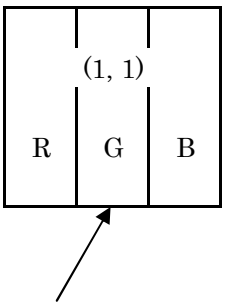
LVDS INTERFACE

27pin AMODE	Signal	Transmitter		Interface Connector		Receiver		TFT Control
		Pin	Input	System Device	TFT Module	Pin	Output	Input
=L (GND)	R0 (LSB)	51	TxIN0	Tx OUT0+	Rx IN0+	27	RxOUT0	R0 (LSB)
	R1	52	TxIN1			29	RxOUT1	R1
	R2	54	TxIN2			30	RxOUT2	R2
	R3	55	TxIN3			32	RxOUT3	R3
	R4	56	TxIN4			33	RxOUT4	R4
	R5	3	TxIN6	Tx OUT0-	Rx IN0-	35	RxOUT6	R5
	G0 (LSB)	4	TxIN7			37	RxOUT7	G0 (LSB)
	G1	6	TxIN8	Tx OUT1+	Rx IN1+	38	RxOUT8	G1
	G2	7	TxIN9			39	RxOUT9	G2
	G3	11	TxIN12			43	RxOUT12	G3
	G4	12	TxIN13			45	RxOUT13	G4
	G5	14	TxIN14			46	RxOUT14	G5
	B0 (LSB)	15	TxIN15	Tx OUT1-	Rx IN1-	47	RxOUT15	B0 (LSB)
	B1	19	TxIN18			51	RxOUT18	B1
	B2	20	TxIN19	Tx OUT2+	Rx IN2+	53	RxOUT19	B2
	B3	22	TxIN20			54	RxOUT20	B3
	B4	23	TxIN21			55	RxOUT21	B4
	B5	24	TxIN22			1	RxOUT22	B5
	RSVD 1)	27	TxIN24			3	RxOUT24	Not use
	RSVD 1)	28	TxIN25	Tx OUT2-	Rx IN2-	5	RxOUT25	Not use
	DTMG	30	TxIN26			6	RxOUT26	DTMG
	R6	50	TxIN27	Tx OUT3+	Rx IN3+	7	RxOUT27	R6
	R7 (MSB)	2	TxIN5			34	RxOUT5	R7 (MSB)
	G6	8	TxIN10			41	RxOUT10	G6
	G7 (MSB)	10	TxIN11			42	RxOUT11	G7 (MSB)
	B6	16	TxIN16			49	RxOUT16	B6
	B7 (MSB)	18	TxIN17	Tx OUT3-	Rx IN3-	50	RxOUT17	B7 (MSB)
	RSVD 1)	25	TxIN23			2	RxOUT23	Not use
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK

27pin AMODE	Signal	Transmitter		Interface Connector		Receiver		TFT Control
		Pin	Input	System Device	TFT Module	Pin	Output	Input
=H (3.3V)	R2	51	TxIN0	Tx OUT0+	Rx IN0+	27	RxOUT0	R2
	R3	52	TxIN1			29	RxOUT1	R3
	R4	54	TxIN2			30	RxOUT2	R4
	R5	55	TxIN3			32	RxOUT3	R5
	R6	56	TxIN4			33	RxOUT4	R6
	R7 (MSB)	3	TxIN6	Tx OUT0-	Rx IN0-	35	RxOUT6	R7 (MSB)
	G2	4	TxIN7			37	RxOUT7	G2
	G3	6	TxIN8	Tx OUT1+	Rx IN1+	38	RxOUT8	G3
	G4	7	TxIN9			39	RxOUT9	G4
	G5	11	TxIN12			43	RxOUT12	G5
	G6	12	TxIN13			45	RxOUT13	G6
	G7 (MSB)	14	TxIN14			46	RxOUT14	G7 (MSB)
	B2	15	TxIN15	Tx OUT1-	Rx IN1-	47	RxOUT15	B2
	B3	19	TxIN18			51	RxOUT18	B3
	B4	20	TxIN19	Tx OUT2+	Rx IN2+	53	RxOUT19	B4
	B5	22	TxIN20			54	RxOUT20	B5
	B6	23	TxIN21			55	RxOUT21	B6
	B7 (MSB)	24	TxIN22			1	RxOUT22	B7 (MSB)
	RSVD 1)	27	TxIN24			3	RxOUT24	Not use
	RSVD 1)	28	TxIN25	Tx OUT2-	Rx IN2-	5	RxOUT25	Not use
	DTMG	30	TxIN26			6	RxOUT26	DTMG
	R0 (LSB)	50	TxIN27	Tx OUT3+	Rx IN3+	7	RxOUT27	R0 (LSB)
	R1	2	TxIN5			34	RxOUT5	R1
	G0 (LSB)	8	TxIN10			41	RxOUT10	G0 (LSB)
	G1	10	TxIN11			42	RxOUT11	G1
	B0 (LSB)	16	TxIN16			49	RxOUT16	B0 (LSB)
	B1	18	TxIN17	Tx OUT3-	Rx IN3-	50	RxOUT17	B1
	RSVD 1)	25	TxIN23			2	RxOUT23	Not use
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK

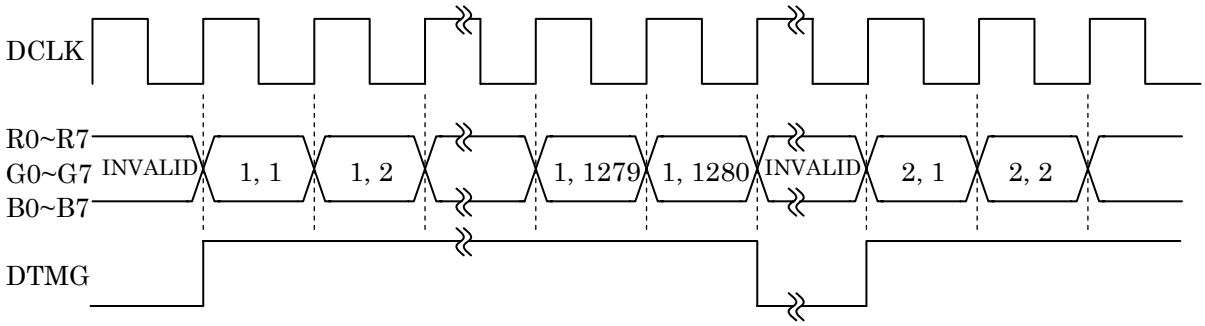
Note 1) RSVD (reserved) pins on the transmitter shall be "H" or "L".

CORRESPONDENCE BETWEEN INPUT DATA AND DISPLAY IMAGE



R0~R7 : R data
G0~G7 : G data
B0~B7 : B data

1, 1	1, 2	1, 3	.....	1, 1280
2, 1	2, 2	2, 3	.....	2, 1280
3, 1	3, 2	3, 3	.....	3, 1280
⋮	⋮	⋮		⋮
768, 1	768, 2	768, 3	.....	768, 1280



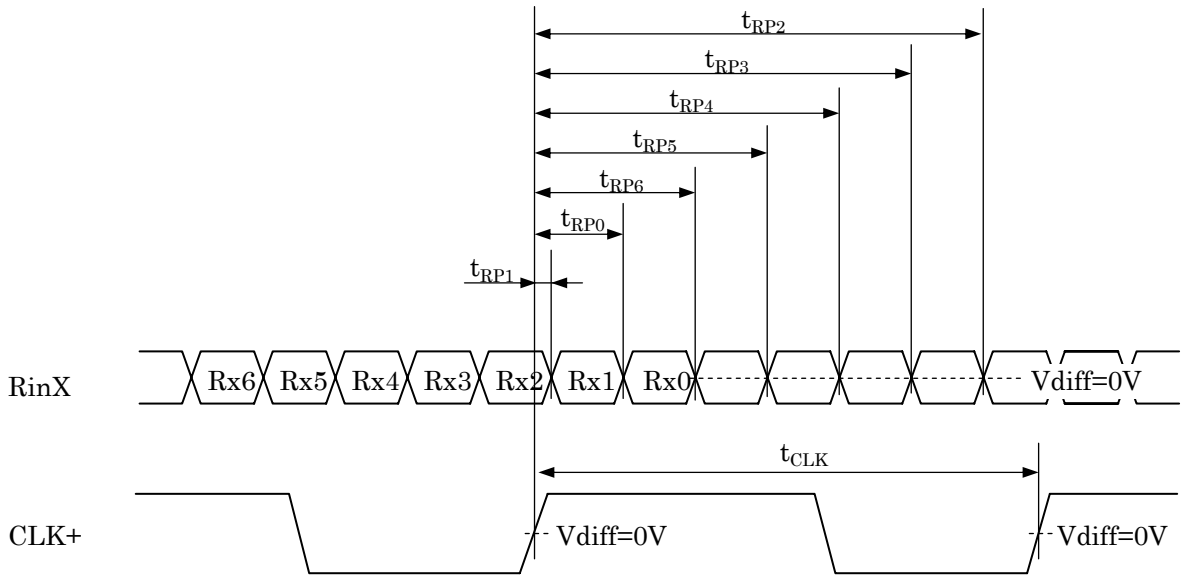
RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT SIGNALS

Color \ Input data		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	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	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	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)
n indicates gray scale level. Higher n means brighter level.
2) Data signals: 1: High, 0: Low

6. INTERFACE TIMING

6.1 LVDS RECEIVER TIMING
(Interface of TFT module)

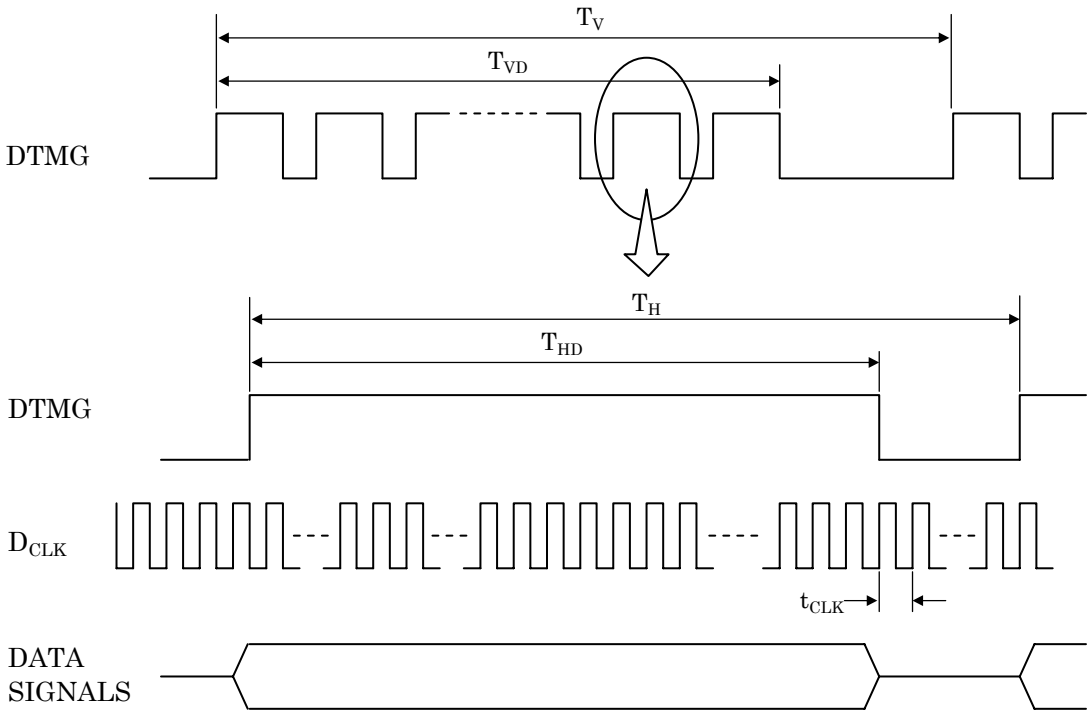


RinX=(RinX+) - (RinX-) (X=0,1,2)

Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	$1/t_{CLK}$	65	66	73	MHz	
RinX (X=0,1,2)	0 data position	t_{RP0}	$1/7t_{CLK}$-0.29	$1/7t_{CLK}$	$1/7t_{CLK}$+0.29	ns	
	1st data position	t_{RP1}	-0.29	0	+0.29		
	2nd data position	t_{RP2}	$6/7t_{CLK}$-0.29	$6/7t_{CLK}$	$6/7t_{CLK}$+0.29		
	3rd data position	t_{RP3}	$5/7t_{CLK}$-0.29	$5/7t_{CLK}$	$5/7t_{CLK}$+0.29		
	4th data position	t_{RP4}	$4/7t_{CLK}$-0.29	$4/7t_{CLK}$	$4/7t_{CLK}$+0.29		
	5th data position	t_{RP5}	$3/7t_{CLK}$-0.29	$3/7t_{CLK}$	$3/7t_{CLK}$+0.29		
	6th data position	t_{RP6}	$2/7t_{CLK}$-0.29	$2/7t_{CLK}$	$2/7t_{CLK}$+0.29		

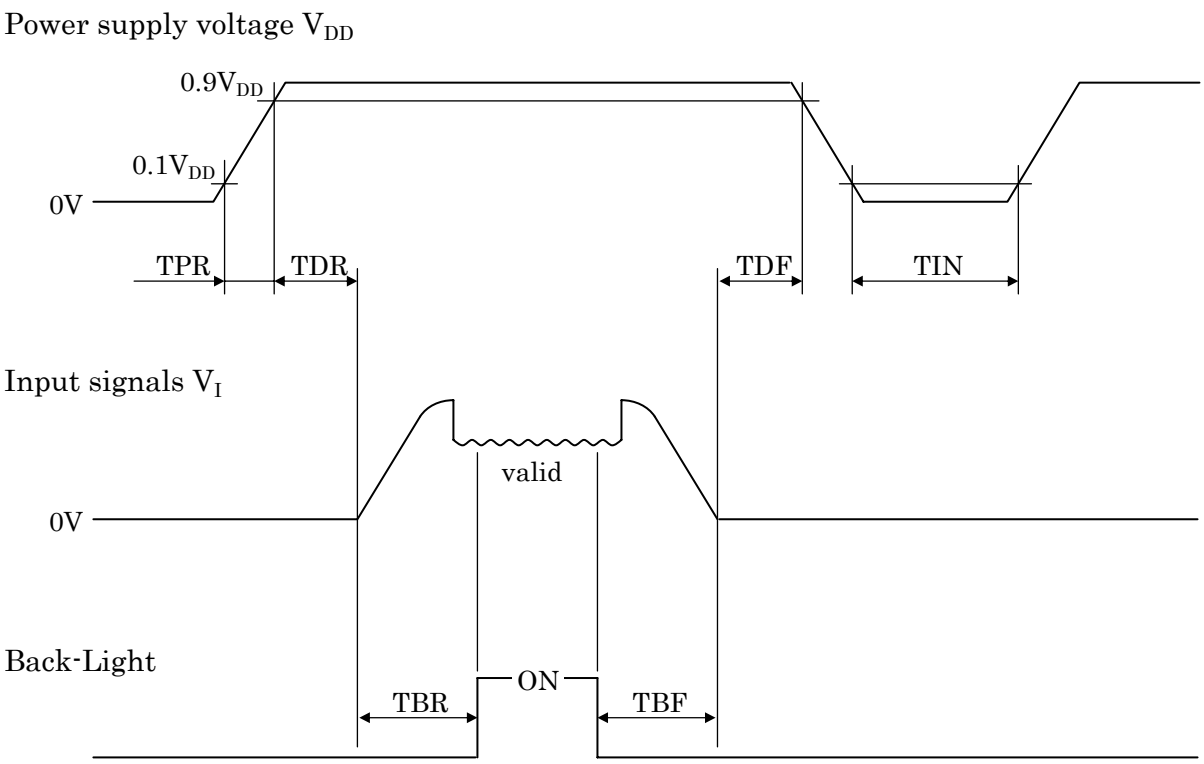
6.2 TIMING CONVERTER TIMING

(Input timing for transmitter)



Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Cycle time	t_{CLK}	13.7	15.1	15.4	ns	
	Duty	D	0.35	0.5	0.65	-	
DTMG	Horizontal period	T_H	1396	1406	1450	t_{CLK}	
	Horizontal width-Active	T_{HD}	1280	1280	1280	t_{CLK}	
	Vertical period	T_V	773	783	825	T_H	
	Vertical width-Active	T_{VD}	768	768	768	T_H	
	Frame frequency	f_V	55	60	65	Hz	

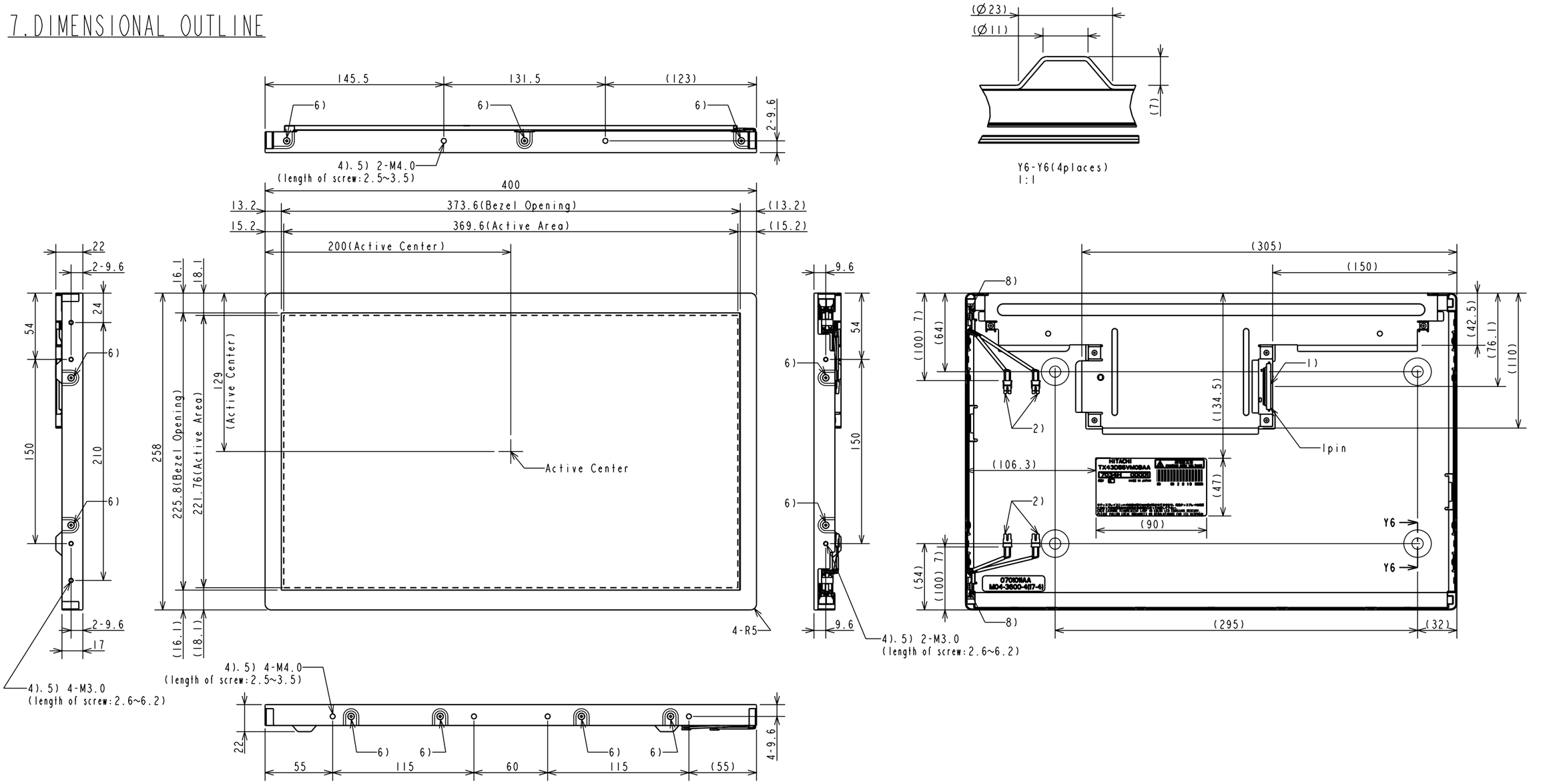
6.3 TIMING BETWEEN INTERFACE SIGNALS AND POWER SUPPLY



Timing of power supply voltage and input signals should be used under the following specifications.

1ms	≤	TPR	≤	10ms
40ms	≤	TDR		
20ms	≤	TDF	≤	50ms
		TIN	≥	1s
		TBR	≥	500ms
		TBF	≥	100ms

7. DIMENSIONAL OUTLINE



NOTE
1) Interface connector (CN1)
   JAE:FI-X30SSL-HF or equivalent
2) CCFL cable connector (CN2~5)
   JST:BHSR-02-VS1 or equivalent
3) The unspecified tolerance:±0.5
4) Hole in mounting panel : M3:6holes(right and left side) , M4:6holes(upper and lower side)
5) Maximum torque for the screw in mounting panel:0.294N·m(3kgf·cm)
6) There are 11 screws that was attched to side of the module.
7) Size when CCFL cable is extended straight.
8) CCFL unit fixing screw.(M2)
   Maximum torque for the screw : 0.196N·m(2kgf·cm)

UNIT:mm

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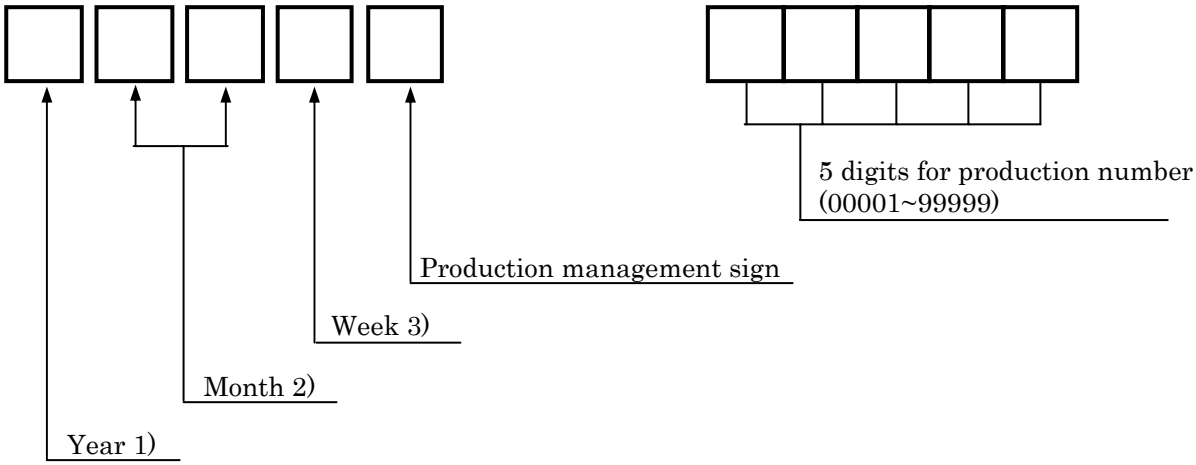
8. DESIGNATION OF LOT MARK

8.1 LOT MARK



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)

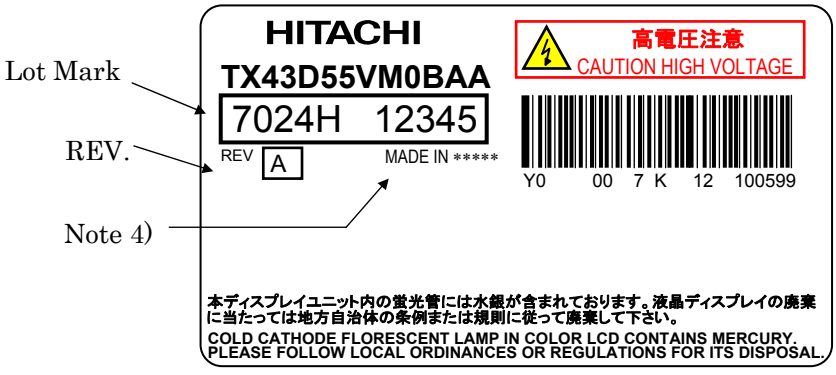
Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

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 4) Indication of place of origin

(*****section)

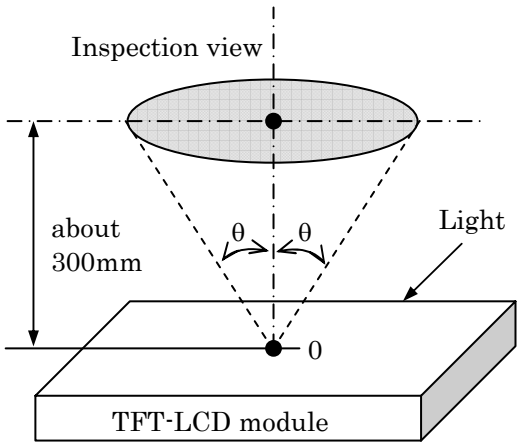
CHINA
JAPAN
TAIWAN

9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

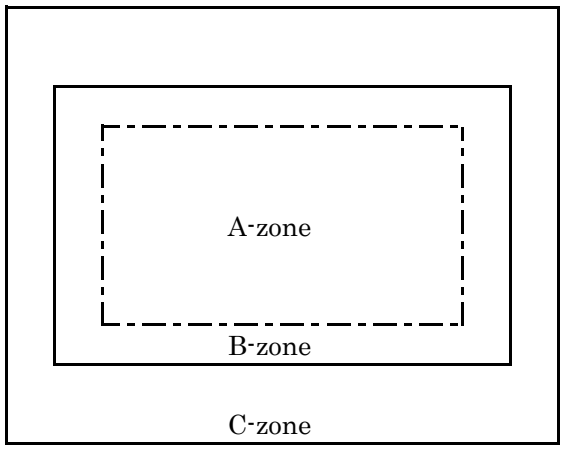
a) The figure shows the correspondence between eyes (of inspector) and TFT-LCD module.
   $\theta < 45°$: when non-operating inspection
   $\theta < 5°$: when operating inspection
b) Inspection should be executed only from front side and only A-zone.
   Cosmetic of B-zone and C-zone are ignore.
   (refer to 9.2 DEFINITION OF ZONE)



(2) Environmental

a) Temperature : 25°C
b) Ambient light : about 700 lx and non-directive when operating inspection.
   : about 1000 lx and non-directive when non-operating inspection.
c) Back-light : when non-operating inspection, back-light should be off.

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 conditions are not stable (ex. at turn on or off), the following specifications are not applied.

	No.	Item			Max. acceptable number A-zone	Unit	Note
Operating inspection	1	Dot Defect	Sparkle mode	1-dot	5	pcs	1),2),4)
				2-dots	2	Units	1),2),5)
				3-dots	0		
				4-dots	0		
				Density	2	pcs/ϕ15mm	1),2),6)
				Total	5	pcs	—
			Black mode	1-dot	10	pcs	1),3),4)
				2-dots	5	Units	1),3),5)
				3-dots	0		
				4-dots	0		
				Density	3	pcs/ϕ5mm	1),3),7)
				Total	10	pcs	—
				Total	15	pcs	—
	2	Line defect			Serious one is not allowed.	—	—
	3	Uneven brightness					
	4	Stain inclusion (Line shape, W: width (mm), L: length (mm))	W ≤ 0.02	L: Ignore	Ignore	pcs	8)
			W ≤ 0.04	L ≤ 4.0	8		
				L > 4.0	0		
			W ≤ 0.08	L ≤ 2.0	8		
				L > 2.0	0		
			W > 0.08	—	See the No.5 Dot shape		
	5	Stain inclusion (Dot shape, D: ave. dia. (mm))	D ≤ 0.22		Ignore	pcs	8)
			D ≤ 0.5		8		
			D > 0.5		0		
	6	Scratch on polarizer (Line shape, W: width (mm), L: length (mm))	W ≤ 0.02	L: Ignore	Ignore		
			W ≤ 0.04	L ≤ 40	10	pcs	9)
				L > 40	0		
			W ≤ 0.08	L ≤ 20	10		
				L > 20	0		
			W > 0.08	—	0		
	7	Scratch on polarizer (Dot shape, D: ave. dia. (mm))	D ≤ 0.2		Ignore	pcs	9)
			D ≤ 0.6		10		
			D > 0.6		0		

	No.	Item		Max. acceptable number A-zone	Unit	Note
non-operating inspection	8	Bubbles, peeling in polarizer (D: ave. dia. (mm))	D ≤ 0.3	Ignore	pcs	9)
			D ≤ 0.5	10		
			D ≤ 1.0	5		
			D > 1.0	0		
	9	Wrinkles on polarizer		Serious one is not allowed.	—	—

Notes 1) Dot defect : defect area > 1/2 dot
2) Sparkle mode : brightness of dot is more than 30% at black. (visible to eye)
3) Black mode: brightness of dot is less than 70% at white. (visible to eye)
4) 1 dot: defect dot is isolated, not attached to other defect dot.
5) N dots: N defect dots are consecutive. (N means the number of defects dots)
6) Density: number of defect dots inside 15mm ϕ.
7) Density: number of defect dots inside 5mm f.
8) Those stains which can be wiped out easily are acceptable.
9) 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.

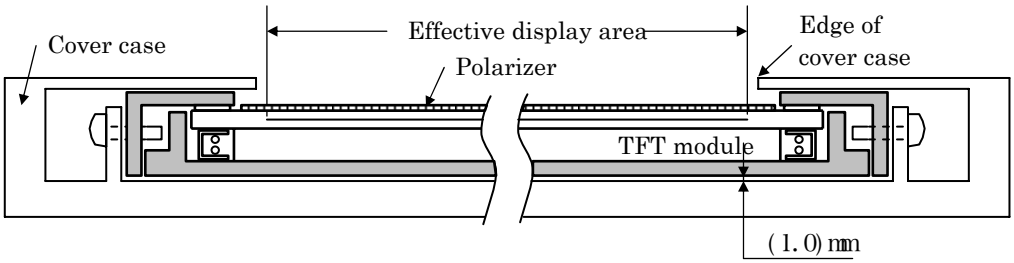


Fig.1 Cross sectional view of a monitor set

(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 peeled 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 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.

10.8 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.

10.9 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.

10.10 OTHERS

(1) Electrical components which may not affect electrical performance are subject to change without prior notice due to an unforeseen change in their availability.