Date : July. 27, 2012

TECHNICAL DATA

Product Name	TX54D14VC0CAA

(NOTES)

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RECORD OF REVISION

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

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

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

Note :The LED driver for the backlight unit is built in this module.

Product Name : TX54D14VC0CAA

GENERAL SPECIFICATIONS

Effective Display Area	: (H) 432.0 × (V) 324.0 (mm)
Number of Pixels	: (H) 1,600 × (V) 1,200 (pixels)
Pixel Pitch	: (H) 0.270 × (V) 0.270 (mm)
Color Pixel Arrangement	: R + G + B Vertical Stripe
Display Mode	: Transmissive Mode Normally Black Mode IPS-Pro
Top Polarizer Type	: Anti-glare
Number of Colors	: 16,777,216 colors
Viewing Angle Range	: Super Wide Version
Input Signal	: 2-channel LVDS (LVDS: Low Voltage Differential Signaling)
Back Light	: Edge Light Type with White LED
External Dimensions	: (H) 460.6 × (V) 362 × (t) 27.5 (mm)
Weight	: Typ. 3,000 (g) (Max.3,400 (g))
RoHS	: Compliance

1. ABSOLUTE MAXIMUM RATINGS

1.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Unit	Note
	Min.	Max.	Min.	Max.		
Temperature	0	50	-20	60	°C	1)
Humidity	2)		2)		%RH	1)
Vibration	—	4.9 (0.5G)	—	9.8 (1.0G)	m/s^2	3)
Shock	—	29.4 (3G)	—	294 (30G)		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 center glass surface of TFT-LCD module, not to the system installed with a module.
The temperature at the center of rear surface should be less than 60°C on the condition of operating.
Function of module is guaranteed in above operating temperature range, but optical characteristics is specified for only 25°C operating condition.

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 100Hz. (Except the resonance point)

4) Pulse width of the shock is 10 ms.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT-LCD Module

Vss=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	0	13.5	V	—
Input Voltage for logic	V_I	-0.3	3.6	V	1)
Electrostatic Durability	V_{ESD0}	±100		V	2),3)
	V_{ESD1}	±8		kV	2),4)

Notes 1) It is applied to pixel data signal and clock signal.

2) Discharge Coefficient: 200pF-250Ω, Environmental: 25°C-70%RH

3) It is applied to I/F connector pins.

4) It is applied to the surface of a metallic bezel and a LCD panel.

(2) Back-Light

Vss=0V

Item	Symbol	Min.	Max.	Unit	Note
Input Voltage	V_{IN}	0	28	V	
ON/OFF Control Input Voltage	ON/OFF	0	5.5	V	
Analog Dimming Signal Voltage	V_{BC}	0	5.5	V	1)
PWM Dimming Signal Voltage	PWM	0	5.5	V	1)

Notes 1) These signals should not be inputted simultaneously.

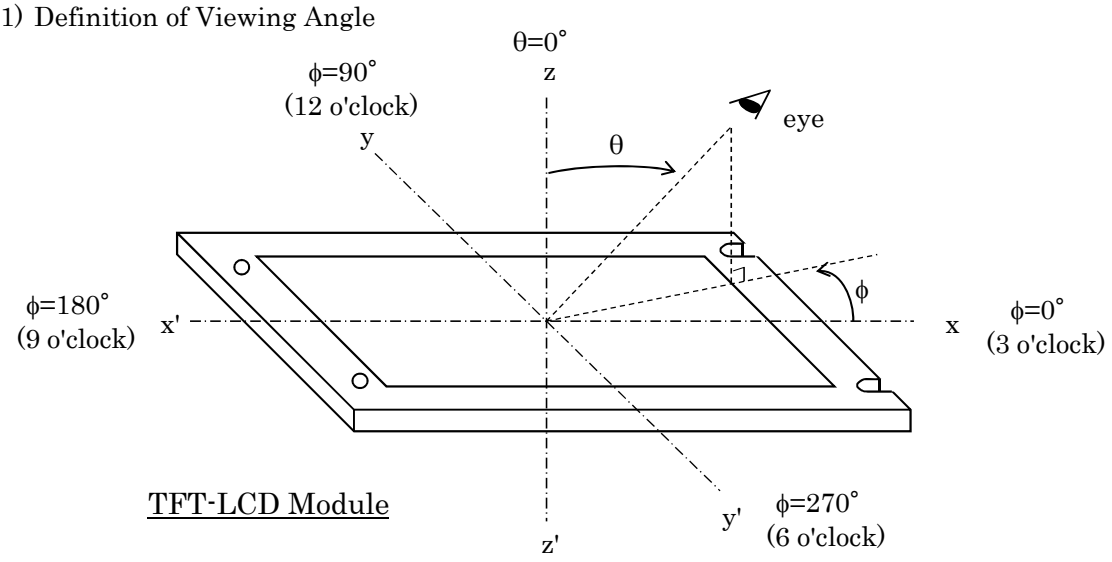
2. OPTICAL CHARACTERISTICS

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 unless otherwise noted.
The optical characteristics should be measured in a dark room or equivalent state.

Measuring equipment :KONICA MINOLTA CS-2000, CS-1000A, CA-210 or EZ-contrast
Ambient Temperature =25±3°C, V_{DD}=12.0V, f_V=60Hz, V_{IN}=24V
and V_{BC}=3.3V or PWM=100%

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ = 0° 1)	700	1100	—	—	2)
Response Time	Rise	ton		—	12	22	ms	3)
	Fall	toff		—	10	21		
Brightness of white		Bwh		680	820	—	cd/m^2	—
Brightness uniformity		Buni		75	—	—	%	4)
Color Chromaticity (CIE)	Red	x		0.620	0.650	0.680	—	(Gray scale = 255)
		y		0.295	0.325	0.355		
	Green	x		0.278	0.308	0.338		
		y		0585	0.615	0.645		
	Blue	x		0.120	0.150	0.180		
		y		0.025	0.055	0.085		
	White	x		0.269	0.299	0.329		
		y		0.285	0.315	0.345		
Variation of Color Position (CIE)	Red	Δx	θ = +50° ϕ = 0°, 90° 180°, 270° 1)	—	—	0.04	—	5) (Gray scale = 255)
		Δy		—	—	0.04		
	Green	Δx		—	—	0.04		
		Δy		—	—	0.04		
	Blue	Δx		—	—	0.04		
		Δy		—	—	0.04		
	White	Δx		—	—	0.04		
		Δy		—	—	0.04		
Contrast Ratio at 85°		CR85°	θ = +85° ϕ = 0°, 90° 180°, 270° 1)	10	—	—	—	—

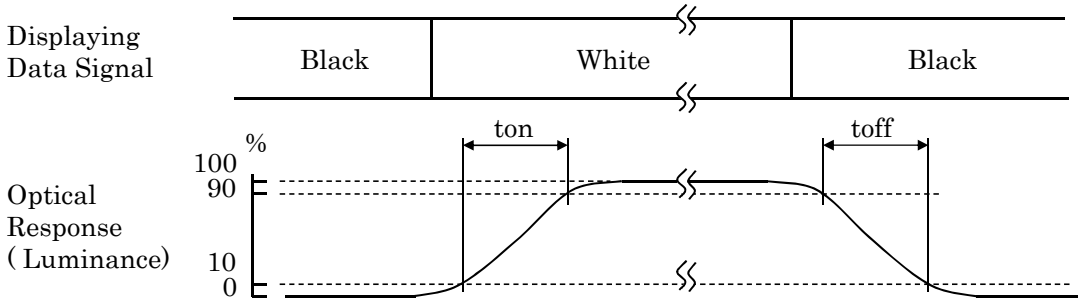
Notes 1) Definition of Viewing Angle



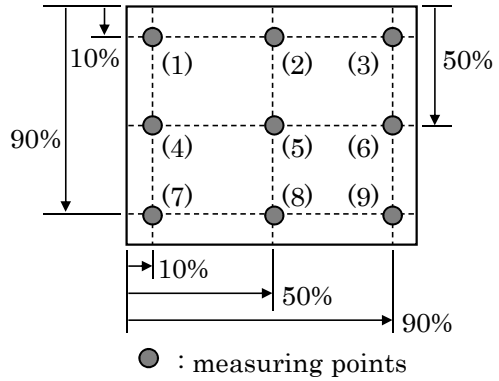
2) Definition of Contrast Ratio (CR)

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

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

5) Variation of color position on CIE is defined as difference between colors at θ = 0° and at θ = 50° & ϕ = 0°, 90°,180°, 270°.

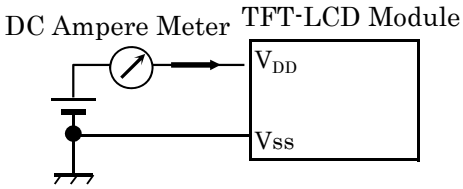
3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD MODULE

Ta=25°C, Vss=0V

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	11.0	12.0	13.0	V	—
Power Supply Current	I_{DD}	—	0.4	0.7	A	1),2),3)
Vsync Frequency	f_V	57	60	63	Hz	—
Hsync Frequency	f_H	—	72	75	kHz	—
DCLK Frequency	f_{CLK}	40	67.5	81	MHz	—

Notes 1) DC current at f_V=60Hz, f_{CLK}=67.5MHz and V_{DD}=12V



2) Current capacity of power supply for V_{DD} should be larger than 5A, so that the fuse can be opened at the trouble of power supply.

3) The picture on maximum current is white picture.

3.2 BACK LIGHT

Ta=25°C

Item		Symbol		Min.	Typ.	Max.	Unit	Note
Input Voltage		V_{IN}		21.6	24	26.4	V	—
Input Current		I_{IN}		—	2.48	2.74	A	4)
ON/OFF Control Voltage	ON	ON/OFF		2.5	—	5.0	V	B/L=ON
	OFF			0	—	0.8	V	B/L=OFF
Brightness Control Voltage		V_{BC}		1.0	—	3.6	V	1), 2)
PWM dimming signal Input Voltage		PWM	High	3.0	—	5.0	V	3)
			Low	0	—	0.8	V	
PWM Frequency		PWM f		125	135	145	Hz	

Notes 1) As for Vbc, it is recommendable to use more than 1.0V.
If Vbc is set less than 1.0V in which brightness becomes less than 20% to the maximum, display image may look unstable since relative change of brightness tends to become large by the slight drift of Vbc.

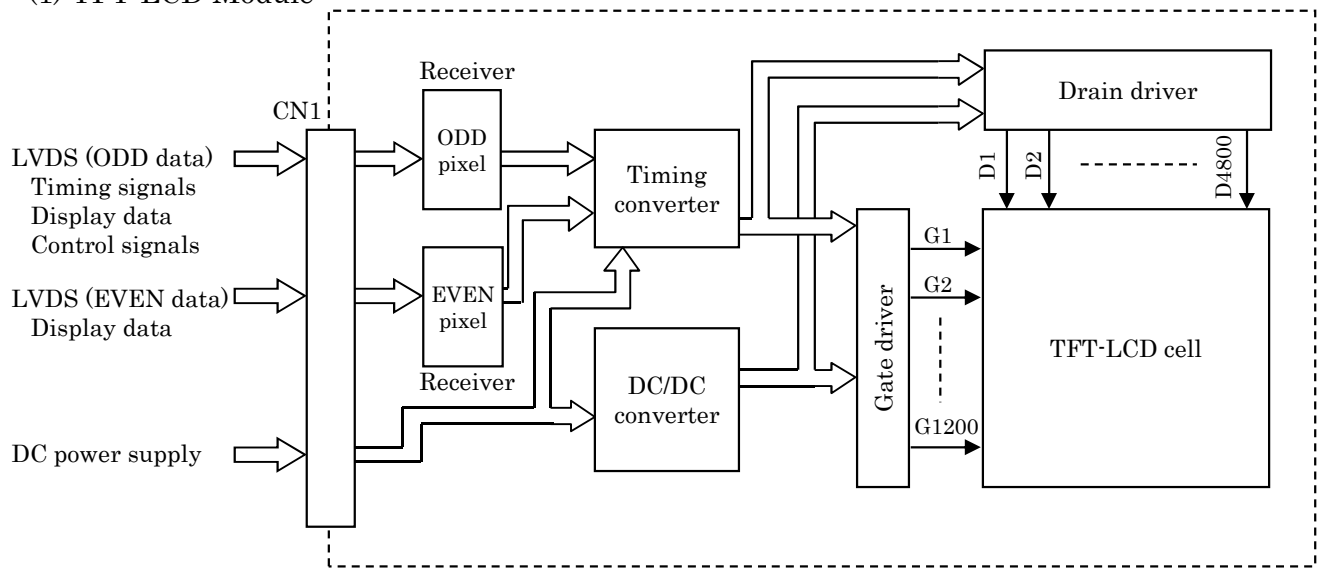
Notes 2) Brightness rises almost linearly by increaseing the Vbc in less than 3.0V.
However, brightness is saturated when Vbc exceeds 3.0V.

Notes 3) Brightness is almost proportional to the on-duty ratio of PWM signal input.

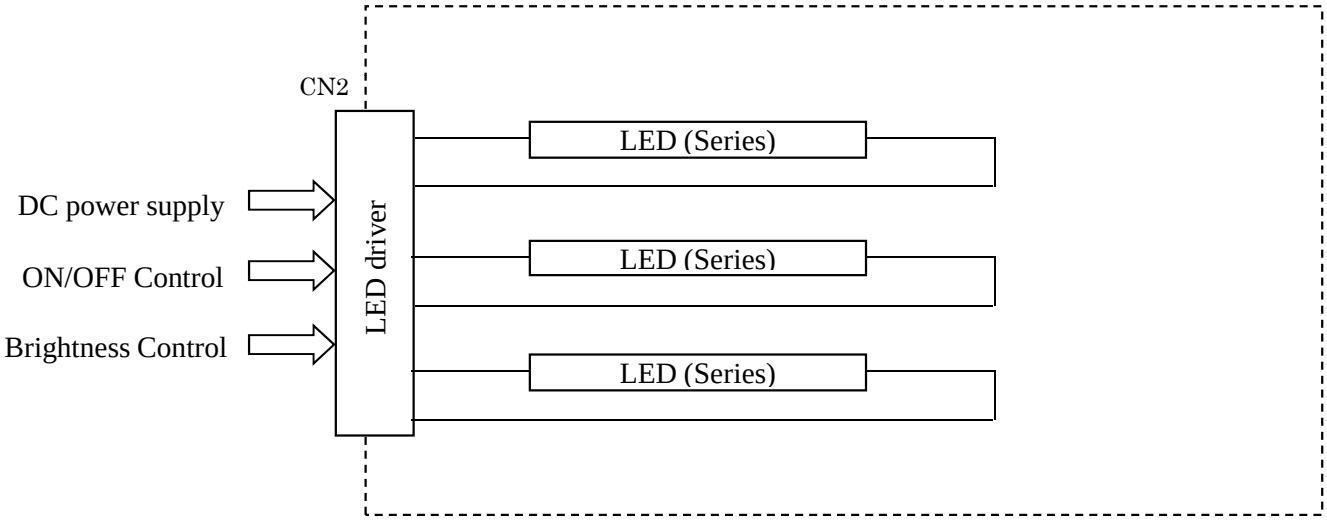
Notes 4) The protection fuse is built into this module. Current capacity of power supply for Vin should be greater than 8A, so that the fuse can blow if there is a problem with the power supply.

4. BLOCK DIAGRAM

(1) TFT-LCD Module



(2) Back Light Unit



5. INTERFACE PIN ASSIGNMENT

5.1 TFT-LCD MODULE

CN1: HIROSE: MDF76GW-30S-1H(55) or Equivalent
(Matching connector: JAE FI-X30H or FI-X30M or Equivalent)

Pin No.	Symbol	Function	Note
1	RAIN0-	ODD pixel data	2)
2	RAIN0+		
3	RAIN1-	ODD pixel data	2)
4	RAIN1+		
5	RAIN2-	ODD pixel data	2)
6	RAIN2+		
7	Vss	GND (0V)	1)
8	RACLKIN-	ODD pixel clock	2)
9	RACLKIN+		
10	RAIN3-	ODD pixel data	2)
11	RAIN3+		
12	RBIN0-	EVEN pixel data	2)
13	RBIN0+		
14	Vss	GND (0V)	1)
15	RBIN1-	EVEN pixel data	2)
16	RBIN1+		
17	Vss	GND (0V)	1)
18	RBIN2-	EVEN pixel data	2)
19	RBIN2+		
20	RBCLKIN-	EVEN pixel clock	2)
21	RBCLKIN+		
22	RBIN3-	EVEN pixel data	2)
23	RBIN3+		
24	Vss	GND (0V)	1)
25	NC	No connection	3)
26	NC	No connection	3)
27	NC	No connection	3)
28	V_{DD}	Power supply (12V)	4)
29	V_{DD}		
30	V_{DD}		

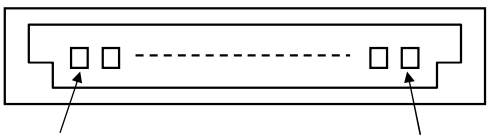
Notes 1) All Vss pins should be grounded.

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

3) Please keep open.

4) All V_{DD} pins should be connected to +12.0 V (typ.).

5) Pin assignment is as follows.



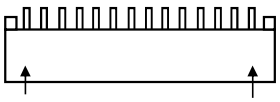
(Figure from top-view)

5.2 BACK-LIGHT UNIT

CN2 : TARNG YU Enterprise TU2001WNR-14S or Equivalent
(Matching connector : JST PHR-14 or TARNG YU Enterprise TU2001HNO-14)

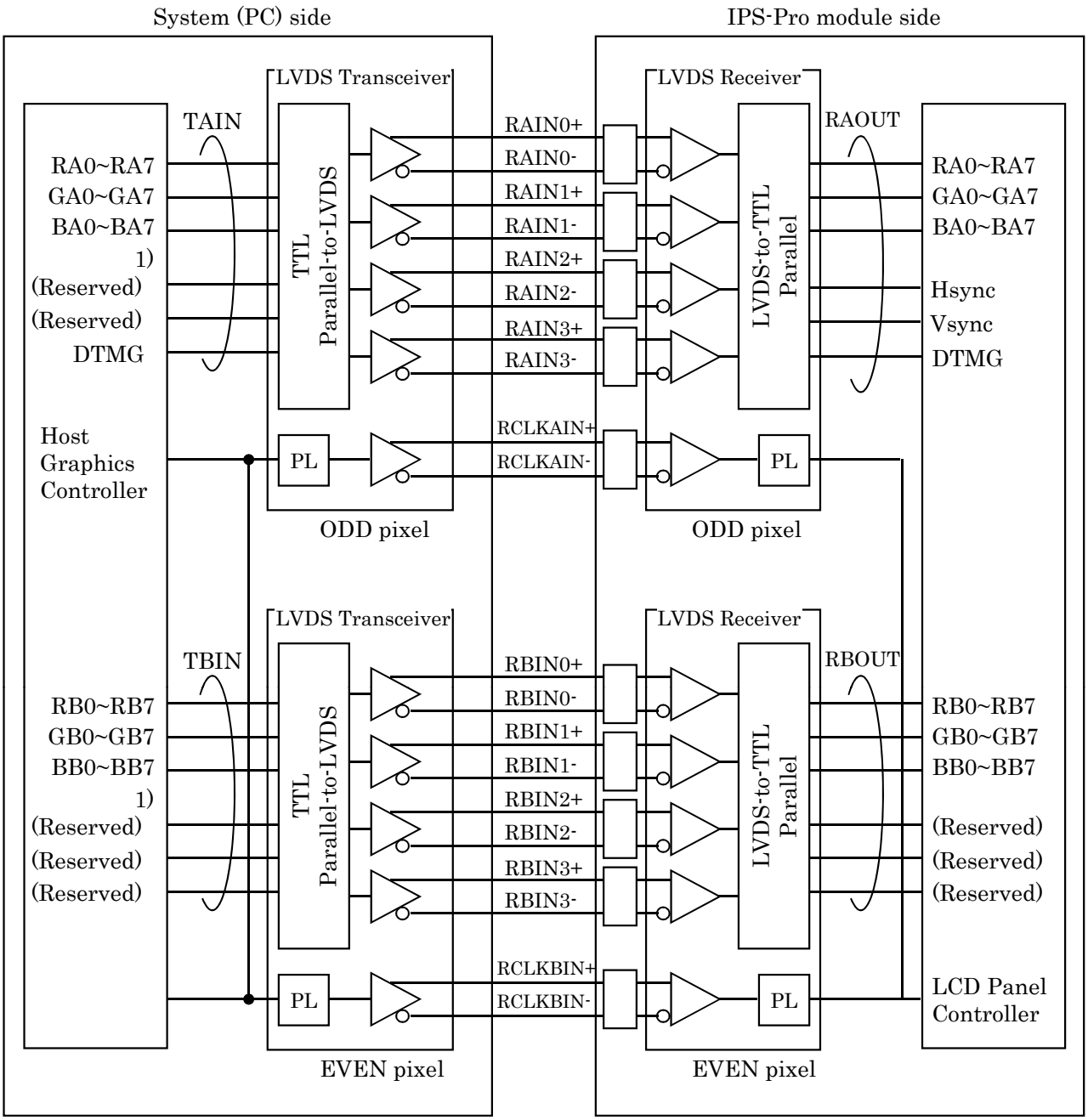
Pin No.	Symbol	Description	Note
1	V_{IN}	Power Supply (typ. 24.0V)	1)
2	V_{IN}		
3	V_{IN}		
4	V_{IN}		
5	V_{IN}		
6	Vss	GND (0V)	2)
7	Vss		
8	Vss		
9	Vss		
10	Vss		
11	NC	NC	3)
12	ON/OFF	High : Backlight ON, Low : Backlight OFF	4)
13	V_{BC}	Brightness Control Signal	5),6)
14	PWM	External PWM for Dimming Control	4),6)

Notes 1) Vin pins should be connected to +24.0V (Typ.).
2) Vss pins should be grounded. The metal bezel is internally connected to GND.
3) Please set the terminal to NC (No Connection).
4) High level:3.0~5.0V, Low level:0~0.8V (High:Max. Brightness, Low:Min. Brightness)
5) Input Voltage : 1.0 ~ 3.6V DC (Brightness becomes maximum at 3.3 +/- 0.3V.)
6) These signals should not be inputted simultaneously. i.e.
when the PWM signal is to be inputted, please set the terminal of V_{BC} to NC. Or
when the V_{BC} signal is to be inputted, please set the PWM terminal to NC.
7) Pin assignment is as follows.



(Figure from top-view)

BLOCK DIAGRAM OF INTERFACE



RA0~7, RB0~7 : R data
GA0~7, GB0~7 : G data
BA0~7, BB0~7 : B data
DTMG : Display timing data

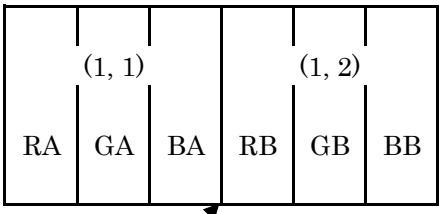
Receiver: Equivalent of THC63LVDF84B by THine

Notes 1) RSVD (reserved) pins on a transmitter should be connected with Vss.
2) The system must have a LVDS transmitter to drive a module.
3) The impedance of LVDS cable should be 50 ohms per a signal line or about 100 ohms per a twist-pair line when it is used differentially.

LVDS INTERFACE

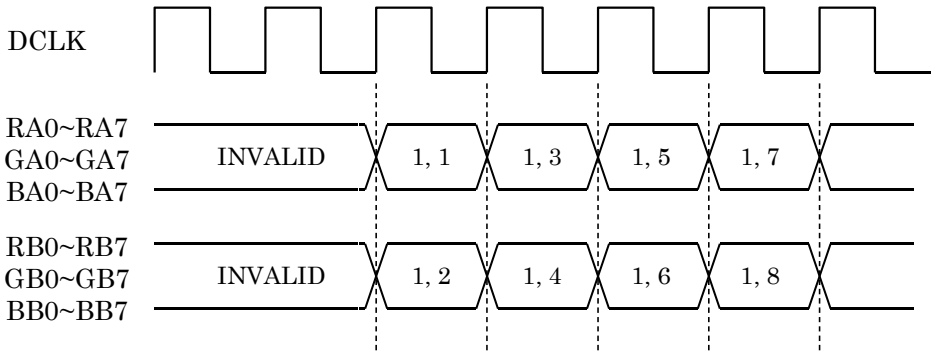
	Input Signal	Transmitter		Interface connector		Receiver		TFT Control input
		Pin	Input	System side	Super-TFT module	Pin	Output	
LVDS ODD	RA0	51	TAIN0	TA OUT0+	RA IN0+	27	RAOUT0	RA0
	RA1	52	TAIN1			29	RAOUT1	RA1
	RA2	54	TAIN2			30	RAOUT2	RA2
	RA3	55	TAIN3			32	RAOUT3	RA3
	RA4	56	TAIN4			33	RAOUT4	RA4
	RA5	3	TAIN6	TA OUT0-	RA IN0-	35	RAOUT6	RA5
	GA0	4	TAIN7			37	RAOUT7	GA0
	GA1	6	TAIN8	TA OUT1+	RA IN1+	38	RAOUT8	GA1
	GA2	7	TAIN9			39	RAOUT9	GA2
	GA3	11	TAIN12			43	RAOUT12	GA3
	GA4	12	TAIN13			45	RAOUT13	GA4
	GA5	14	TAIN14			46	RAOUT14	GA5
	BA0	15	TAIN15	TA OUT1-	RA IN1-	47	RAOUT15	BA0
	BA1	19	TAIN18			51	RAOUT18	BA1
	BA2	20	TAIN19	TA OUT2+	RA IN2+	53	RAOUT19	BA2
	BA3	22	TAIN20			54	RAOUT20	BA3
	BA4	23	TAIN21			55	RAOUT21	BA4
	BA5	24	TAIN22			1	RAOUT22	BA5
	RSVD 1)	27	TAIN24			3	RAOUT24	RSVD
	RSVD 1)	28	TAIN25	TA OUT2-	RA IN2-	5	RAOUT25	RSVD
	DTMG	30	TAIN26			6	RAOUT26	DTMG
	RA6	50	TAIN27	TA OUT3+	RA IN3+	7	RAOUT27	RA6
	RA7	2	TAIN5			34	RAOUT5	RA7
	GA6	8	TAIN10			41	RAOUT10	GA6
	GA7	10	TAIN11			42	RAOUT11	GA7
	BA6	16	TAIN16			49	RAOUT16	BA6
	BA7	18	TAIN17	TA OUT3-	RA IN3-	50	RAOUT17	BA7
	RSVD 1)	25	TAIN23			2	RAOUT23	RSVD
	DCLK	31	TCLKA IN	TCLKA OUT+ TCLKA OUT-	RCLKA IN+ RCLKA IN-	26	RCLKA OUT	DCLK
LVDS EVEN	RB0	51	TBIN0	TB OUT0+	RB IN0+	27	RBOUT0	RB0
	RB1	52	TBIN1			29	RBOUT1	RB1
	RB2	54	TBIN2			30	RBOUT2	RB2
	RB3	55	TBIN3			32	RBOUT3	RB3
	RB4	56	TBIN4			33	RBOUT4	RB4
	RB5	3	TBIN6	TB OUT0-	RB IN0-	35	RBOUT6	RB5
	GB0	4	TBIN7			37	RBOUT7	GB0
	GB1	6	TBIN8	TB OUT1+	RB IN1+	38	RBOUT8	GB1
	GB2	7	TBIN9			39	RBOUT9	GB2
	GB3	11	TBIN12			43	RBOUT12	GB3
	GB4	12	TBIN13			45	RBOUT13	GB4
	GB5	14	TBIN14			46	RBOUT14	GB5
	BB0	15	TBIN15	TB OUT1-	RB IN1-	47	RBOUT15	BB0
	BB1	19	TBIN18			51	RBOUT18	BB1
	BB2	20	TBIN19	TB OUT2+	RB IN2+	53	RBOUT19	BB2
	BB3	22	TBIN20			54	RBOUT20	BB3
	BB4	23	TBIN21			55	RBOUT21	BB4
	BB5	24	TBIN22			1	RBOUT22	BB5
	RSVD 1)	27	TBIN24			3	RBOUT24	RSVD
	RSVD 1)	28	TBIN25	TB OUT2-	RB IN2-	5	RBOUT25	RSVD
	RSVD 1)	30	TBIN26			6	RBOUT26	RSVD
	RB6	50	TBIN27	TB OUT3+	RB IN3+	7	RBOUT27	RB6
	RB7	2	TBIN5			34	RBOUT5	RB7
	GB6	8	TBIN10			41	RBOUT10	GB6
	GB7	10	TBIN11			42	RBOUT11	GB7
	BB6	16	TBIN16			49	RBOUT16	BB6
	BB7	18	TBIN17	TB OUT3-	RB IN3-	50	RBOUT17	BB7
	RSVD 1)	25	TBIN23			2	RBOUT23	RSVD
	DCLK	31	TCLKB IN	TCLKB OUT+ TCLKB OUT-	RCLKB IN+ RCLKB IN-	26	RCLKB OUT	DCLK

CORRESPONDENCE BETWEEN INPUT DATA AND DISPLAY IMAGE



ODD pixel: RA0~RA7 : R data
GA0~GA7 : G data
BA0~BA7 : B data
EVEN pixel: RB0~RB7 : R data
GB0~GB7 : G data
BB0~BB7 : B data

1, 1	1, 2	1, 3	.....	1, 1600
2, 1	2, 2	2, 3	.....	2, 1600
3, 1	3, 2	3, 3	.....	3, 1600
⋮	⋮	⋮		⋮
1200, 1	1200, 2	1200, 3	.....	1200, 1600



RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT SIGNALS

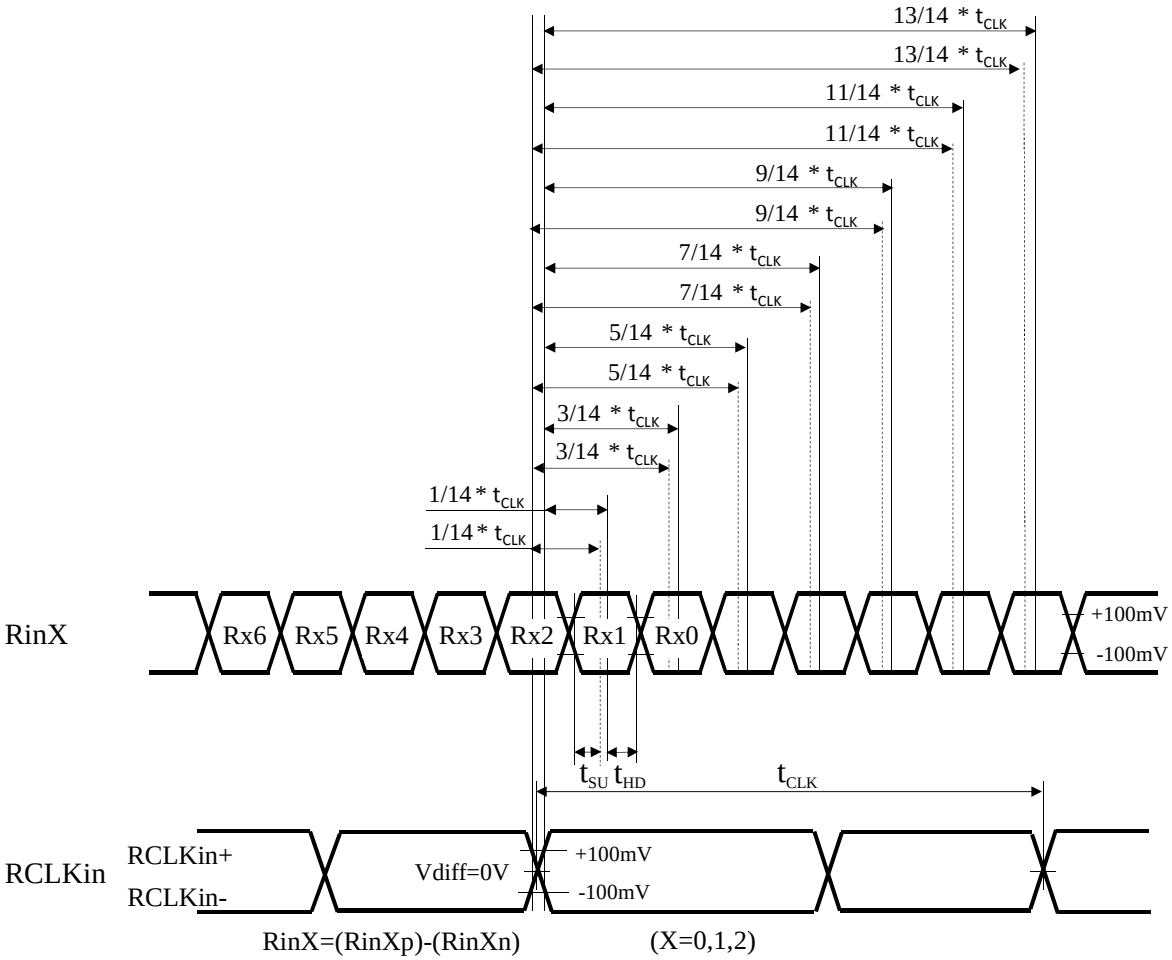
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	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 CHARACTERISTICS

(Regulation with the Input Terminal of the Module)



Item		Condition	Symbol	Min.	Typ.	Max.	Unit	Remarks
DCLK frequency			$1/t_{CLK}$	40	67.5	81	MHz	
RinX (X=0,1,2)	Set up time	t_{CLK}=12ns	t_{SU}	350	-	-	ps	
		t_{CLK}=15ns		450	-	-		
		t_{CLK}=25ns		1000	-	-		
	Hold time	t_{CLK}=12ns	t_{HD}	350	-	-		
		t_{CLK}=15ns		450	-	-		
		t_{CLK}=25ns		1000	-	-		

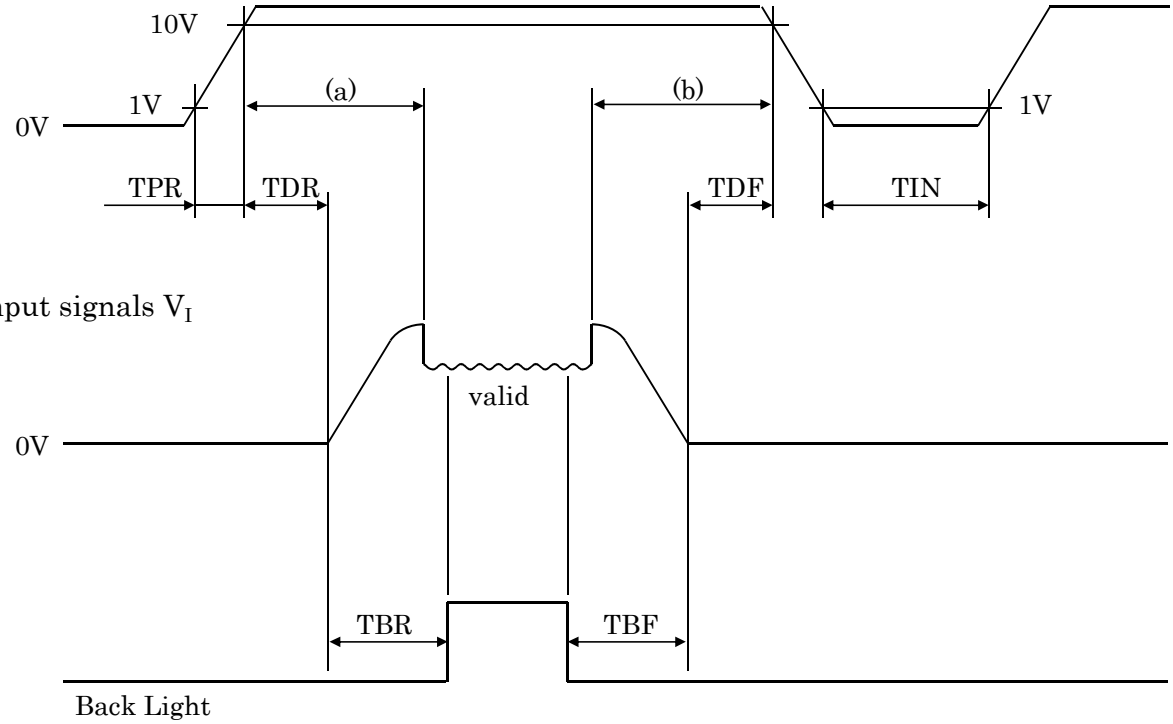
6.2 TIMING PARAMETERS

2pxl/clk

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	40	67.5	81	MHz	—
	High Time	T_{CH}	4	—	—	nsec	
	Low Time	T_{CL}	4	—	—	nsec	
Data	Setup Time	T_{DS}	4	—	—	nsec	
	Hold Time	T_{DH}	4	—	—	nsec	
DTMG	Setup Time	T_{ES}	4	—	—	nsec	
Frame Frequency	Cycle	T_V	15.90	16.7	17.5	msec	
			1,203	1,203	1,270	lines	—
Vertical Active Display Term	Display Period	T_{VD}	1,200	1,200	1,200	lines	—
	Vertical Blank Period	T_{VB}	3	3	70	lines	—
One Line Scanning Time	Cycle	T_H	840	936	1,080	clocks	—
Horizontal Active Display Term	Display Period	T_{HD}	800	800	800	clocks	—

6.3 TIMING BETWEEN INTERFACE SIGNALS AND POWER SUPPLY

Power supply voltage V_{DD}



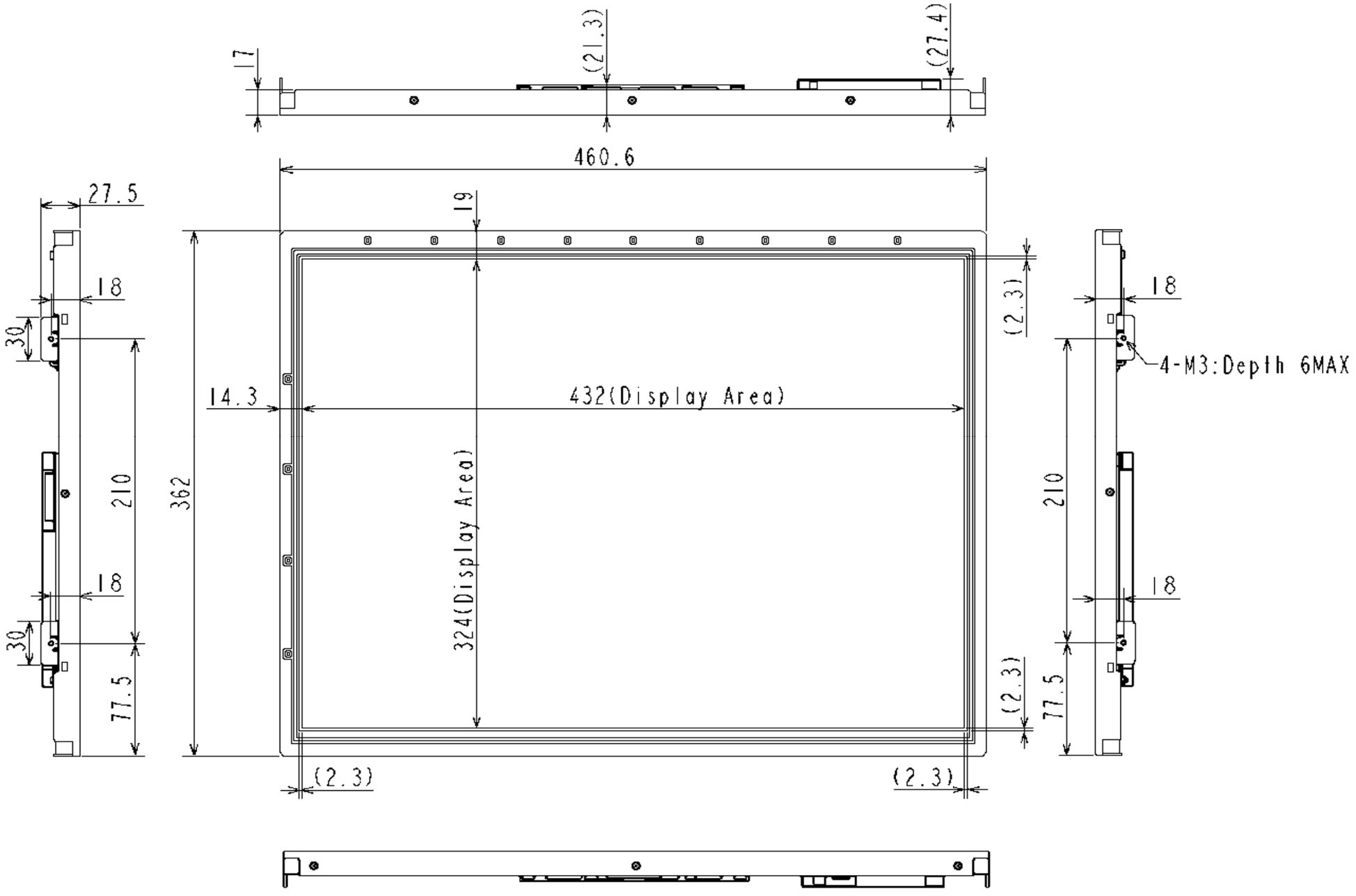
Timing of power supply voltage and input signals should be used under the following specifications.

0ms	≤	TPR	≤	10ms
10ms	≤	TDR	≤	50ms
0ms	≤	TDF	≤	50ms
		TIN	≥	1s
		TBR	≥	500ms
		TBF	≥	100ms

Notes (1) Please set the time of (a) to 500ms, or less.
(a) is the interval from the input of power supply V_{DD} to synchronization signal of UXGA and clock.
(2) Please set the time of (b) 1s, or as short as possible.
(b) is the interval from the input to synchronization signal of UXGA and clock to the power supply OFF.
When the synchronization signal or clock becomes off, please set the input signal for the display image to black.
(3) V_{DD} supply without synchronization signal and clock input should be avoided to avoid abnormal display or module defect.

7. DIMENSIONAL OUTLINE

(1) Front View



Note 1) Dimension in parentheses are reference value.
Tolerance not specified is +/- 0.5mm.
Maximum torque for M3 screw: 0.588N-m.

Unit: mm
Scale:NTS

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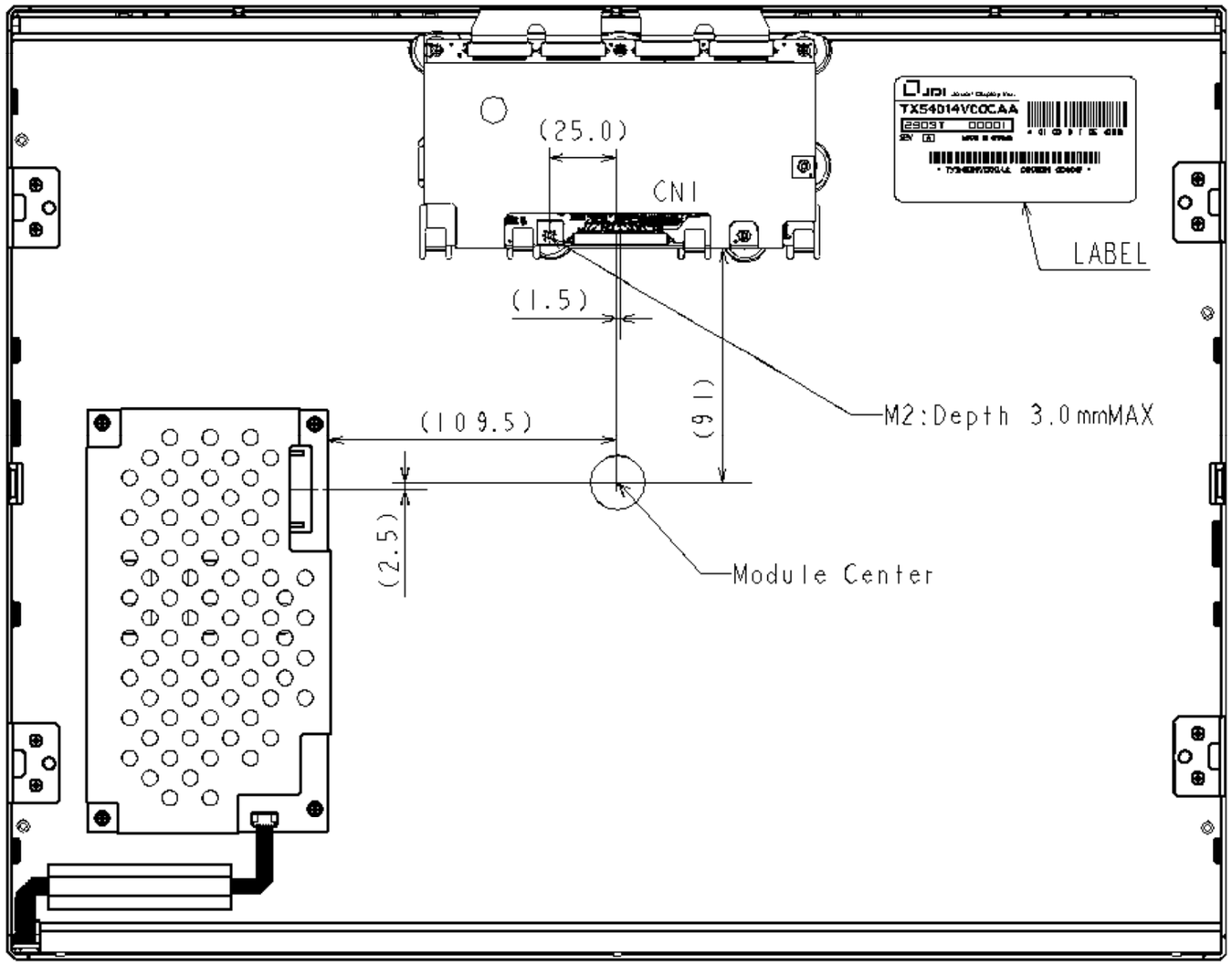
(2) Rear View

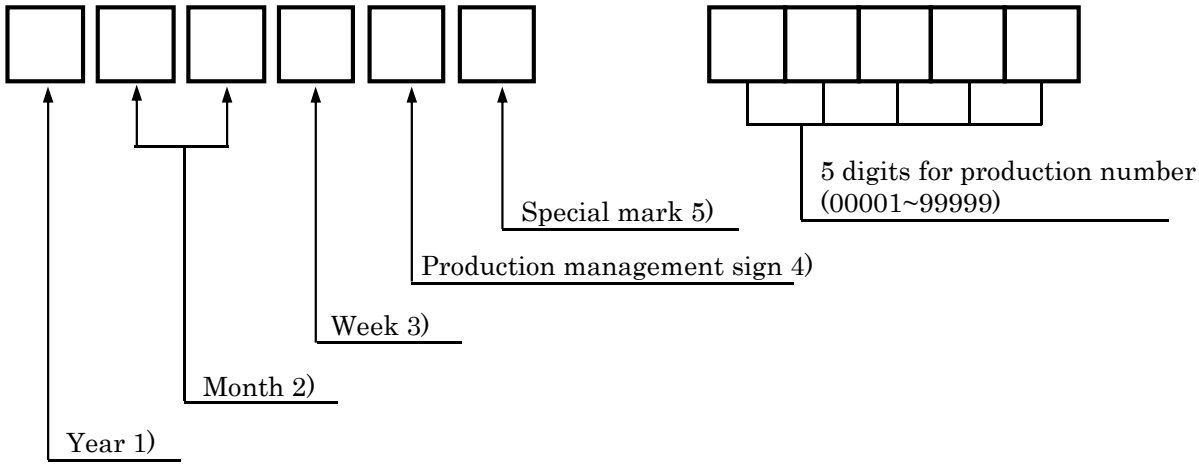


Note 1) Dimension in parentheses are reference value.
2) Tolerance not specified is +/- 0.5mm.
3) LED driver is protected by the plastic cover. For this cover, please take the clearance at least 10mm from conductive materials such as back chassis in order to suppress the electromagnetic coupling.

Unit: mm
Scale:NTS

8. DESIGNATION OF LOT MARK

8.1 LOT MARK



Notes

1)

Year	Mark
2012	2
2013	3
2014	4
2015	5
2016	6

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)

Production management sign	
H	Made in Japan
T	Made in Taiwan

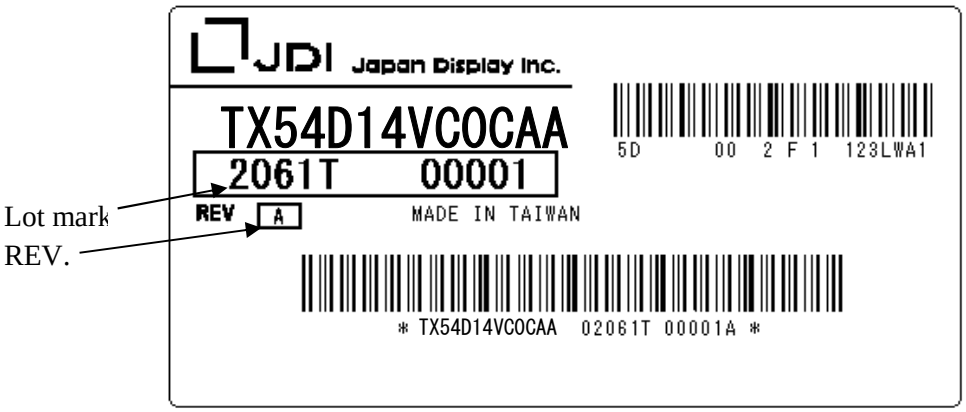
5) It is the mark that was opened up by production person to take correspondence with production number.

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

The Lot mark is a label. The label is on the rear bezel as shown in 7. DIMENSIONAL OUTLINE. The style of character can be changed without prior notice.

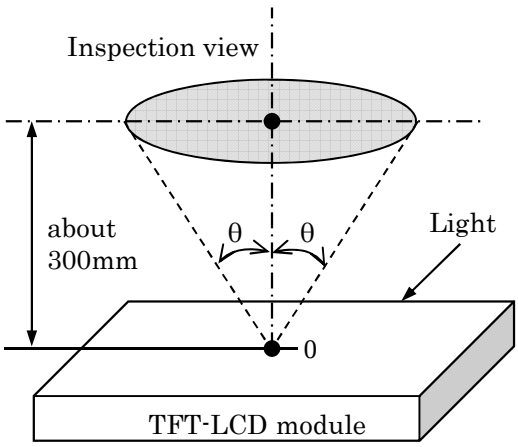


9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

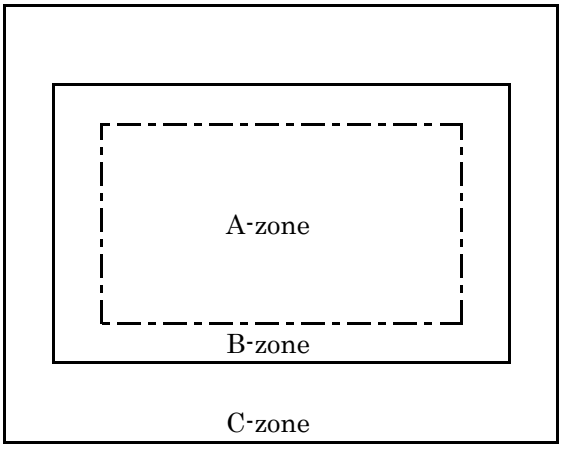
a) The figure shows the correspondence between eyes (of inspector) and TFT-LCD module.
   θ ≤ 45° : when non-operating inspection
   θ ≤ 5° : when operating inspection
b) Inspection should be executed only from front side and only A-zone.
   Cosmetic of B-zone and C-zone are ignore.
   (refer to 9.2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



(2) Environment

a) Temperature : 25°C
b) Ambient light : Sufficient darker condition 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		0	pcs	1), 2), 4)
				2-dot		0	pcs	1), 2), 5)
				3-dot		0		
				4-dots		0		
				Density		0	pcs/ϕ20mm	1), 2), 6)
				Total		0	pcs	-
			Black mode	1-dot		7	pcs	1), 3), 4)
				2-dot		3	Units	1), 3), 5)
				3-dot		0		
				4-dots		0		
				Density		2	pcs/ϕ20mm	1), 3), 6)
				Total		7	pcs	-
			Total (Without slightly bright dot)			10	pcs	-
	2	Line defect				Serious one is not allowed.	—	-
	3	Uneven brightness						
	4	Stain inclusion (Line shape, W: width (mm), L: length (mm))		W ≤ 0.1	L < 1.0	4	pcs	7)
					L ≥ 1.0	0		
	5	Stain inclusion (Dot shape, D: ave. dia. (mm))		D ≤ 0.22		Ignore	pcs	7)
				D ≤ 0.4		5		
				0.4 < D ≤ 0.5		4		
				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 ≤ 0.04	L ≤ 40	10		
					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	8)
				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	8)
			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 DDL:147(W≧147,R≧147,G≧147,B≧147) at Black (0 level).

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 20mm ϕ.

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 close attention to the following precautions whilst using, handling and mounting the TFT module.

10.1 PRECAUTION FOR HANDLING AND MOUNTING

(1) Applying excessive force to any part of the module may result in partial deformation of the frame or mould, which could result in permanent damage to the display.

(2) The module should be held gently and firmly using both hands. In order to avoid internal damage, never hold the module by just one hand. Also never drop or hit the module.

(3) The module should be installed using the mounting holes of the module.

(4) Uneven force such as twisted stress should not be applied directly to the module once it is mounted within the cover case. The cover case must have sufficient strength such that any external forces are not transmitted directly to the module.

(5) It is recommended that you maintain a gap between the display module and the rear chassis so as to avoid any mechanical stress being passed to the module.

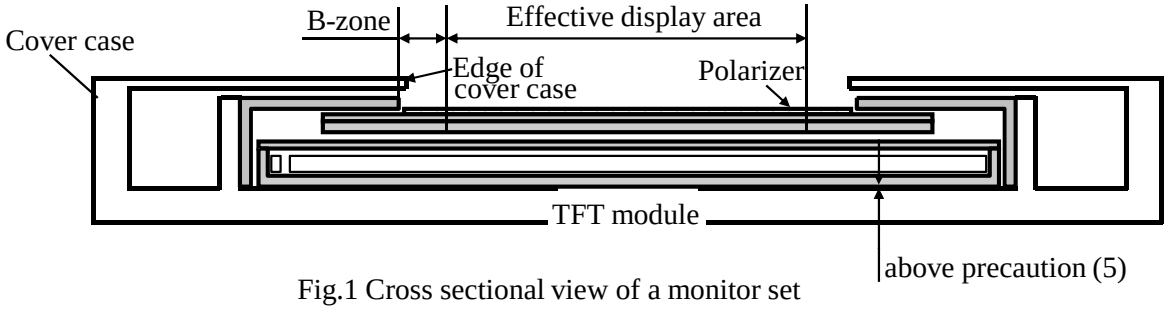


Fig.1 Cross sectional view of a monitor set

(6) The edge of the cover case should be positioned with more than a 1mm overlap from the edge of the module's upper frame.

(7) A transparent protective plate should be added to the front of the display in order to protect both the polarizer and TFT cell. The transparent protective plate should have sufficient strength such that the plate can not be deformed, due to external forces, and touch the module.

(8) Materials containing acetic acid and chlorine should not be used for the cover case nor for other parts which are positioned in close proximity to the module. This is because the Acetic acid will attack the polarizer, whilst the chlorine will attack the electric circuits by way of electro-chemical reaction.

(9) The front polarizer on the TFT cell should be handled carefully, due to its softness, and must not be touched, pushed or rubbed with glass, tweezers or anything harder than an HB pencil lead.
The surface of the polarizer should not be touched nor rubbed with bare hands, greasy or dusty clothes.

(10) If the surface of polarizer becomes dirty, it should be gently wiped using an absorbent cotton, chamois or other soft material with recommended potion. Do not rub strongly to avoid damaging the surface. IPA (isopropyl alcohol) is recommended to clean away the traces of adhesive which is used to attach the front/rear polarizers to the TFT cell. Other cleaning chemicals such as acetone, toluene and alcohol should not be used to clean adhesives because they cause chemical damage to the polarizer.

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

(12) The module should not be opened or modified, under any circumstances, as this may cause it to malfunction.

(13) The metallic bezel of the module should not be handled with bare hand or dirty gloves. Otherwise, the color of the metallic frame may become dirty during its storage. It is recommended to use clean soft gloves and clean finger stalls whilst the module is handled during incoming inspection and production assembly processes.
(14) Please pay attention to the packing and handling not to apply strong Z axis vibration. Because during our vibration test, of course we didn't have any functional failure, but we observed very tiny bright dots (within spec though) at Z axis direction.

10.2 PRECAUTION TO OPERATION

(1) Spike noise could result in the mis-operation of this module. The level of spike noise should be as follows:
-200mV ≤ over- and under- shoot of V_{DD} ≤ +200mV
V_{DD} including over- and under- shoot should not exceed the absolute maximum ratings.
(2) Optical response times, luminance and chromaticity depend on the temperature of the TFT module.
(3) Sudden temperature changes may cause dew on and/or in the module. Dew can cause damage to the polarizer and/or electrical contacting areas of the module. Dew causes fading of the image quality.
(4) Using screen saver is recommended that it avoids any potential of sticking image.
(5) This module has high frequency circuits. Sufficient suppression to electromagnetic interference should be done by the system manufacturers. Grounding and shielding methods may be effective to minimize such interference.
(6) Noise may be heard when the back-light is operated. If necessary, sufficient suppression should be done by the system manufacturers.
(7) The module should not be connected or disconnected whilst the main system is operating.
(8) Connecting or disconnecting the I/F cables, whilst the power and data signals are present, could result in permanent damage to the module. The I/F connectors should only be connected and disconnected after the power supply and data signal have been turned off.
(9) 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.

10.3 ELECTROSTATIC DISCHARGE CONTROL

(1) This module consists of a TFT cell and electronic circuits with CMOS-ICs, which are very susceptible to electrostatic discharge. Persons who are handling the module should be grounded through adequate methods such as a wrist band. I/F connector pins should not be touched directly with bare hands.
(2) The polarizer protective film should be removed slowly so as to avoid an excessive build-up of electrostatic charge.

10.4 PRECAUTION TO STRONG LIGHT EXPOSURE

(1) The module should not be exposed to strong light. Otherwise, characteristics of the polarizer and color filter, may be degraded.

10.5 PRECAUTION TO STORAGE

When modules are stored, for long period's of time, the following precautions should be taken:
(1) Modules should be stored in a dark place. It is prohibited to apply direct sunlight or fluorescent light during storage. Modules should be stored between 0 to 35°C at normal humidity (60%RH or less).
(2) The surface of the polarizer should not come into direct contact with other objects.
It is recommended that modules should be stored in the original shipping box.

10.6 PRECAUTION TO HANDLING PROTECTION FILM

(1) The protective film for polarizers should be pealed off slowly and carefully by people who are electrically grounded with adequate methods such as wrist bands. Also ionized air should be blown over the module during the peeling process.
Dust on the polarizer should be blown off gently using an ionized nitrogen gun.

(2) The protective film should be peeled off carefully to avoid it rubbing on the polarizer. If the film rubs together with the polarizer it is possible that a small amount of adhesive may remain on the polarizer.

(3) The module with protective film should be stored under the conditions explained in 10.5 (1). However , in case's where the storage time is excessive, some adhesive may remain on the polarizer even after the protective film has been removed. In the case where a module is stored at higher temperatures and/or higher humidity, adhesive may remain on the polarizer. Any remaining adhesive may cause non-uniformity of the displayed image.

10.7 SAFETY

(1) Since the TFT cell is made of glass, handling of any broken module's should be carried out with the utmost care so as to avoid any injury. Hands which have come into direct contact with liquid crystal material should be washed immediately and thoroughly.

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

10.8 USE RESTRICTIONS AND LIMITATIONS

(1) In no event shall Japan Display Inc. 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 there of in advance. These limitations apply to all causes action in aggregate, including without limitation breach of contract, breach of warranty, negligence, strict liability, misrepresentation and other torts.

(2) This product is not authorized for military applications or other applications which pose a significant risk of personal injury.

(3) This specification is valid only for a bare panel. The specification values are not valid for a panel after fabrication work, which gives any effect on panel characteristics such as disassemble, glass bonding, or else.