To : Mindray Medical International, Ltd.

August 27, 2013

TECHNICAL DATA	
Product Name	**LAM170M023A**

(NOTES)

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The information described in this technical specification is tentative and it is possible to be changed without prior notice.

RECORD OF REVISION

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

APPLICATION

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

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

DESCRIPTION

This specification is applied to the following 17inch SXGA IPS-Pro-TFT module.

Note : The LED driver for back light unit is built in this module.

General Specifications

Part Name	: LAM170M023A
Effective Display Area	: H337.92 × V270.336 [mm]
Number of Pixels	: H1280 × V1024 [pixels]
Pixel Pitch	: H0.264 × V0.264 [mm]
Color Pixel Arrangement	: R+G+B Vertical Stripe
Display Mode	: Transmissive Mode Normally Black Mode IPS-Pro
Top Polarizer Type	: Anti-glare(Hardness:2H)
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) 368.0 × (V) 306.0 × (t) 19.9 (mm)
Weight	: 1600 g typ.

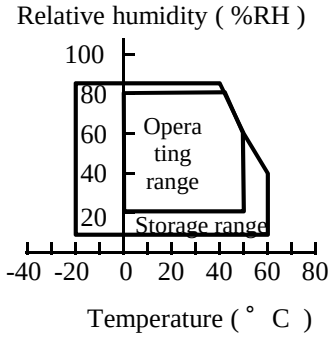
1. ABSOLUTE MAXIMUM RATINGS

1.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

ITEM	Operating		Storage		Unit	Note
	Min.	Max.	Min.	Max.		
Temperature	0	50	-20	60	°C	1) 5)
Humidity	2)		2)		%RH	1) 5)
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 LCD surface of TFT 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 and cosmetic specs are specified for only initial 25°C operating condition.

2) Ta ≤ 40°C ..... Relative humidity should be 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 approximately 10 ms.

5) In case that the atmosphere temperature repeatedlly radical change, there may happen spot, streak,etc. on the screen due to damage of material.
TFT module should be used in the air-conditioned room with temperature little change.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT Module

Vss=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	0	6.0	V	—
Differential signal input voltage	V_{IL}	-0.3	2.9	V	1)
Electrostatic Durability	V_{ESD0}	±100		V	2),3)
	V_{ESD1}	±8		kV	2),4)

Notes 1) It is applied to LVDS 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	18.0	V	—
ON/OFF Control Input Voltage	ON/OFF	-0.3	6.0	V	—
Analog Dimming Signal Voltage	V_{BC}	-0.3	6.0	V	1),2)
PWM Dimming Signal Voltage	PWM	-0.3	6.0	V	1)

Notes 1) These signals can't input at the same time.(Unused pin is to be left open.)

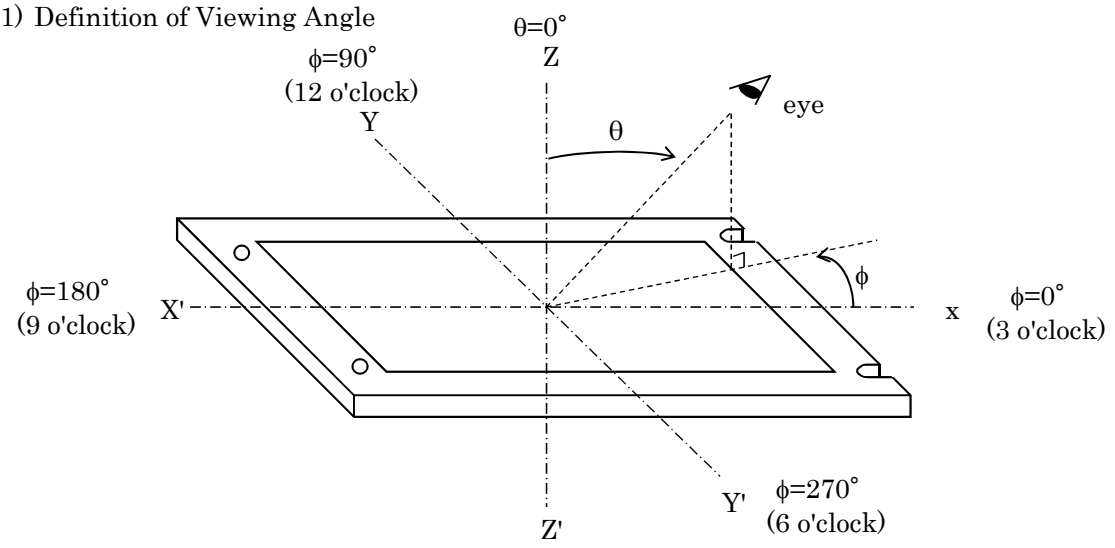
2. OPTICAL CHARACTERISTICS

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.
The values described below are the initial values.

Measuring equipment : KONICA MINOLTA: CS-2000 or equivalent.
Ambient Temperature=25±3°C, V_{DD}=5.0V, f_V=60Hz, V_{IN}=12.0V,
and PWM=100% (PWMf=150Hz)

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast Ratio		CR	θ = 0° 1)	550	900	—	—	2)
Response Time	Rise	ton		—	10	18	ms	3)
	Fall	tof		—	12	20		
Brightness of white		Bwh		190	240	—	cd/m^2	4)
Brightness uniformity		Buni		70	—	—	%	5)
Color Chromaticity (CIE)	Red	x		(0.601)	(0.651)	(0.701)	—	(Gray scale 255)
		y		(0.276)	(0.326)	(0.376)		
	Green	x		(0.294)	(0.314)	(0.364)		
		y		(0.561)	(0.611)	(0.661)		
	Blue	x		(0.099)	(0.149)	(0.199)		
		y		(0.004)	(0.054)	(0.104)		
	White	x		(0.240)	(0.290)	(0.340)		
		y		(0.250)	(0.300)	(0.350)		
Contrast Ratio at 85°		CR85°	θ=+85° φ=0°、90° 180°、270°	(10)	—	—	—	—

Note 1) Definition of Viewing Angle

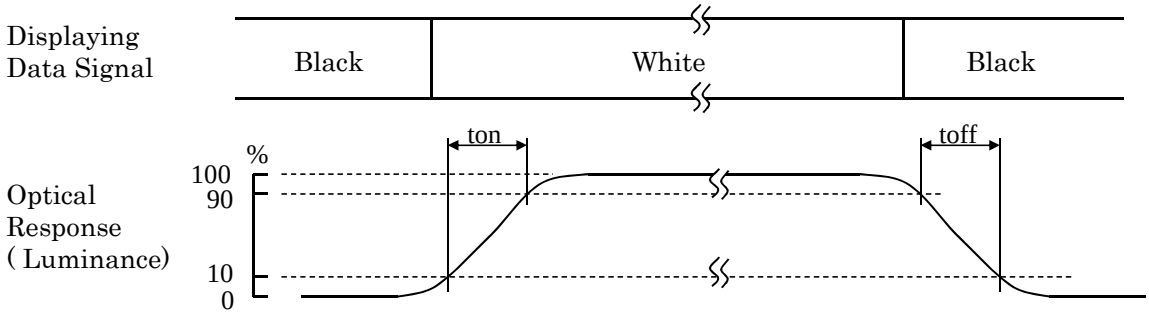


TFT Module

2) Definition of Contrast Ratio

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

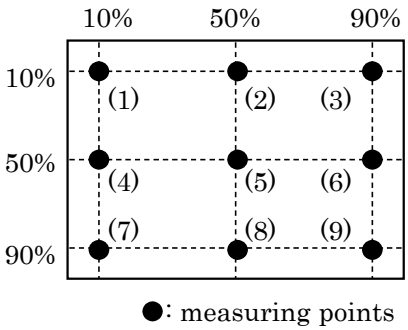
3) Definition of Response Time



* Temperature of LCD surface=30°C

4) Brightness of white is measured 30 minutes later at the LCM lights up.

5) Definition of Brightness Uniformity



●: measuring points

Display pattern is white (255 DDL). The brightness uniformity is defined as the following equation. Brightness at each point is measured, and then Buni can be calculated using the maximum and minimum brightness values.

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

where, Bmax = Maximum brightness

Bmin = Minimum brightness

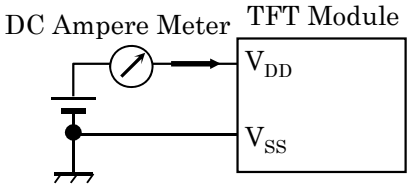
3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD Module Ta=25°C, Vss=0V

ITEM	SYMBOL	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	4.5	5	5.5	V	—
Power Supply Current	I_{DD}	—	610	750	mA	1),2),3)
Differential input voltage for LVDS receiver threshold	V_{ILH}	—	—	+100	mV	V_{CM}=1.2V
	V_{ILL}	-100	—	—	mV	V_{CM}=1.2V
Vsync Frequency	f_V	—	60	76 *	Hz	—
Hsync Frequency	f_H	—	64	—	kHz	—
DCLK Frequency	f_{CLK}	40	54	67.5	MHz	—

* The LCD panel works ordinarily when fv is set between 60Hz and 76Hz.
However, picture quality and optical characteristics can be guaranteed only at fv=60Hz.
If the LCD is used other than fv=60Hz, customers are requested to check picture quality of the LCD under customers' specific conditions.

Note 1) DC current at fv=60.0Hz, fCLK=54MHz and VDD=5.0V



2) As this module contains current fuse(1.6A),please prepare current source that is enough for cutting current fuse (larger than 5.0A) or set protection circuit when a trouble happens.

3) It is the current value with the white picture (255DDL).

3.2 BACK LIGHT

Ta=25°C

Item		Symbol		Min.	Typ.	Max.	Unit	Note
Input Voltage		V_{IN}		10.8	12.0	13.2	V	—
Input Current		I_{IN}		—	1.0	1.44	A	1), 2)
ON/OFF Control Voltage	ON	ON/OFF		2.5	3.3	5.0	V	B/L=ON
	OFF			0	—	0.5	V	B/L=OFF
	Current	I_{BL}		—	—	1.0	mA	ON/OFF=5.0V
Brightness Control Voltage		V_{BC}		1.0	3.3	3.6	V	3),5)
		I_{BC}		—	—	1.0	mA	V_{BC}=3.6V
PWM dimming signal Input Voltage		PWM	High	2.5	3.3	5.0	V	4),5),7)
			Low	0	—	0.9	V	
		I_{PWM}		—	1.0	—	mA	6)
PWM Frequency		PWMf		140	150	160	Hz	—

Notes

1) I_{IN} Typ: V_{IN}=12.0V, ON/OFF=3.3V, PWM=100%(PWMf=150Hz)
   I_{IN} Max: V_{IN}=10.8V, ON/OFF=3.3V, PWM=100%(PWMf=150Hz)

2) As this module contains current fuse(3.0A),please prepare current source that is enough for cutting current fuse (larger than 8.0A) or set protection circuit when a trouble happens.

3) Brightness Control (Reference value)

V_{BC} (Typ.)	Brightness
1.0V	20%
1.3V	30%
1.5V	40%
1.8V	50%
2.0V	60%
2.3V	70%
2.5V	80%
2.8V	90%
Above 3.0V	100%

In case of using VBC for brightness control, Backlight flickering may be seen due to electrical noise caused by Power Supply ability. Please check it with your actual set.
VBC should be set more than 1.0V.
Display image may look unstable if VBC is less than 1.0V.

4) Brightness Control (Reference value)

PWM (Typ.)	Brightness
5%	5%
10%	10%
20%	20%
30%	30%
40%	40%
50%	50%
60%	60%
70%	70%
80%	80%
90%	90%
100%	100%

Display image may look unstable if the on-duty ratio is less than 5%.

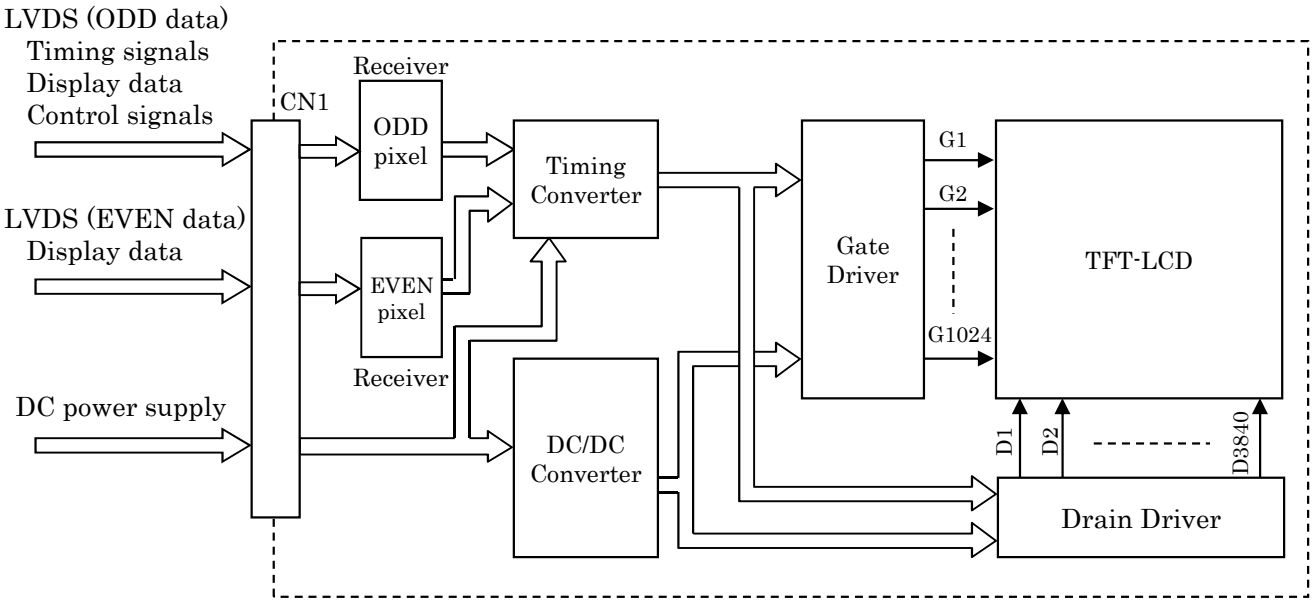
5) These signals can't input at the same time.(Unused pin is to be left open.)

6) PWM pin has inrush current during PWM signal is to be high, this value depends on output impedance of external device. For example, Pulse Generator with 50ohm output impedance has 27mA PWM input current (I_{PWM}) of this LED driver during 50 μ s.

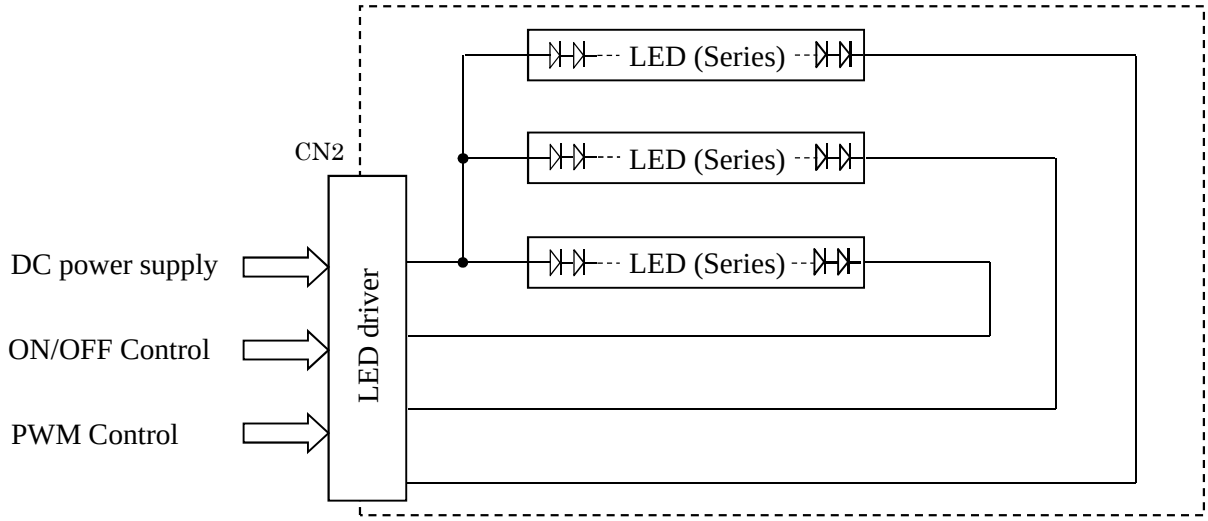
7) Resolution of PWM signal has to be 256 at a maximum.

4. BLOCK DIAGRAM

(1) TFT Module



(2) Back light unit



5. INTERFACE PIN ASSIGNMENT

5.1 TFT-LCD MODULE

CN1 HIROSE: MDF76GW-30S-1H 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 data	2)
9	RACLKIN+		
10	RAIN3-	ODD pixel clock	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 clock	2)
19	RBIN2+		
20	RBCLKIN-	EVEN pixel data	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 (+5.0V)	4)
29	V_{DD}		
30	V_{DD}		

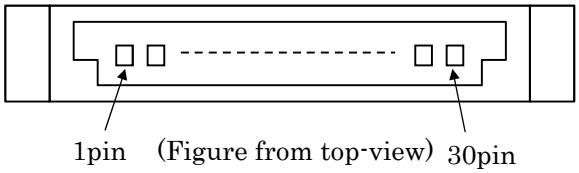
Note 1) All Vss pins should be grounded.

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 VDD pins should be connected to +5.0 V(typ.).

5) Pin assignment is as follows.

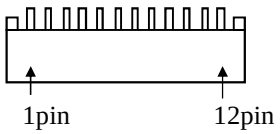


5.2 BACK-LIGHT UNIT

CN2 : TARNG YU Enterprise: TU2001WNR-12S or Equivalent
(Matching connector : JST: PHR-12 or TARNG YU Enterprise: TU2001HNO-12)

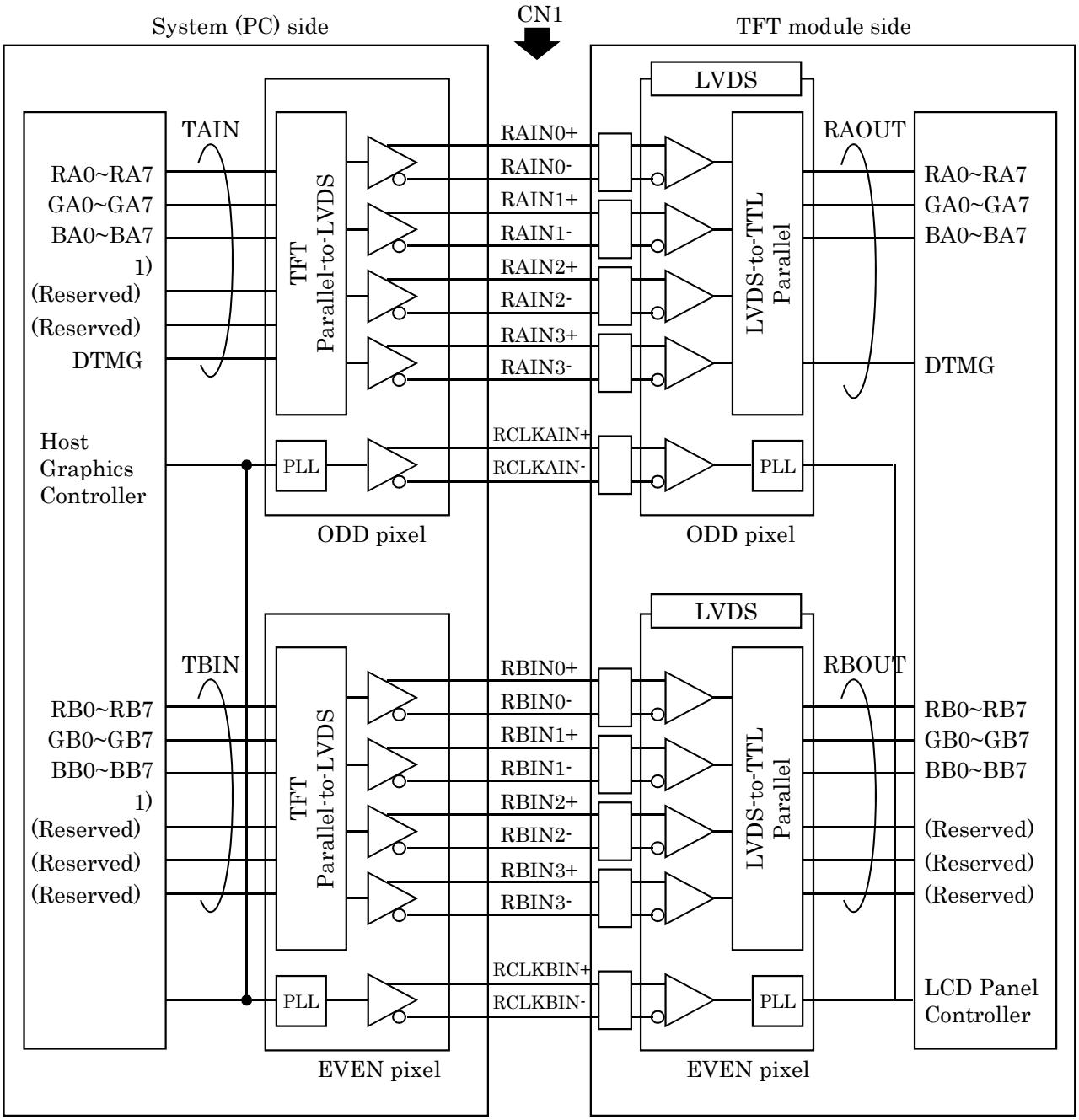
Pin No.	Symbol	Description	Note
1	V_{IN}	Power Supply (typ. 12.0V)	1)
2	V_{IN}		
3	V_{IN}		
4	V_{IN}		
5	ON/OFF	High : Backlight ON, Low : Backlight OFF	4)
6	V_{SS}	GND (0V)	2)
7	V_{SS}		
8	V_{BC}	Brightness Control Signal	5), 6)
9	PWM	PWM Dimming Signal	3), 6)
10	NC	No connection	7)
11	V_{SS}	GND (0V)	2)
12	V_{SS}		

Notes 1) All V_{IN} pins should be connected to +12.0V (Typ.).
2) All V_{SS} pins should be grounded. The metal bezel is internally connected to GND.
3) High level:2.5 ~ 5.0V, Low level:0 ~ 0.9V
4) High level:2.5 ~ 5.0V DC, Low level:0 ~ 0.5V DC
5) Input Voltage : 1.0 ~ 3.6V DC
6) These signals can't input at the same time.(Unused pin is to be left open.)
7) Please keep open.
8) Pin assignment is as follows.



(Figure from top-view)

BLOCK DIAGRAM OF INTERFACE



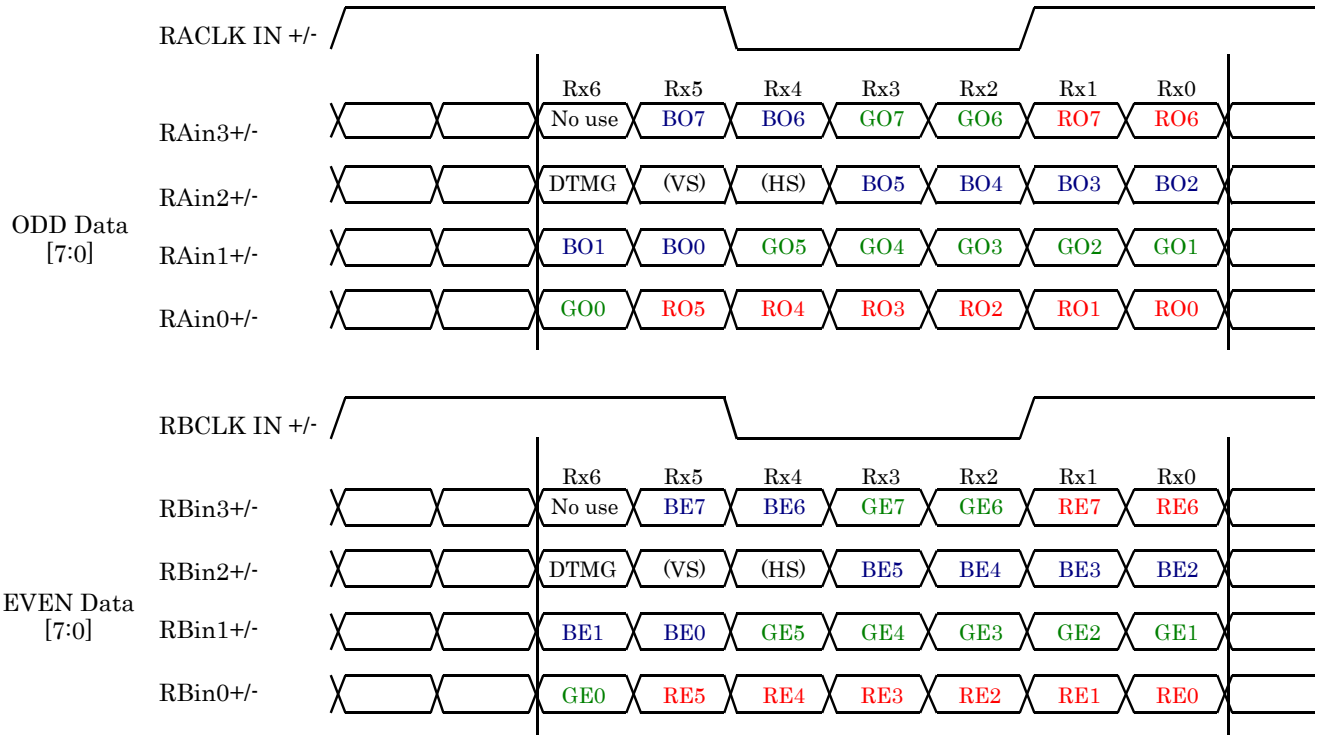
RA0~7, RB0~7 : R data
GA0~7, GB0~7 : G data
BA0~7, BB0~7 : B data
DTMG : Display timing data

Receiver: Equivalent of THC63LVDF84B by THine

Note 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.

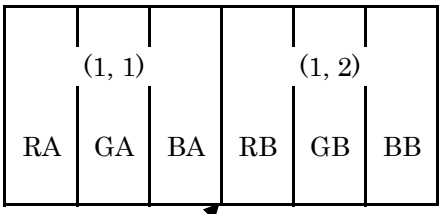
LVDS INTERFACE

8bit Digital



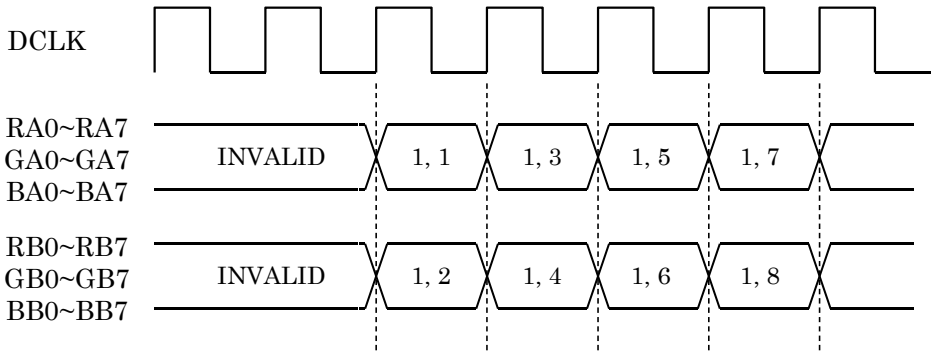
8 bit x 3 LVDS Interface Format

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, 1280
2, 1	2, 2	2, 3	.....	2, 1280
3, 1	3, 2	3, 3	.....	3, 1280
⋮	⋮	⋮		⋮
1024, 1	1024, 2	1024, 3	.....	1024, 1280



RELATIONSHIP BETWEEN DISPLAY COLORS AND INPUT SIGNALS

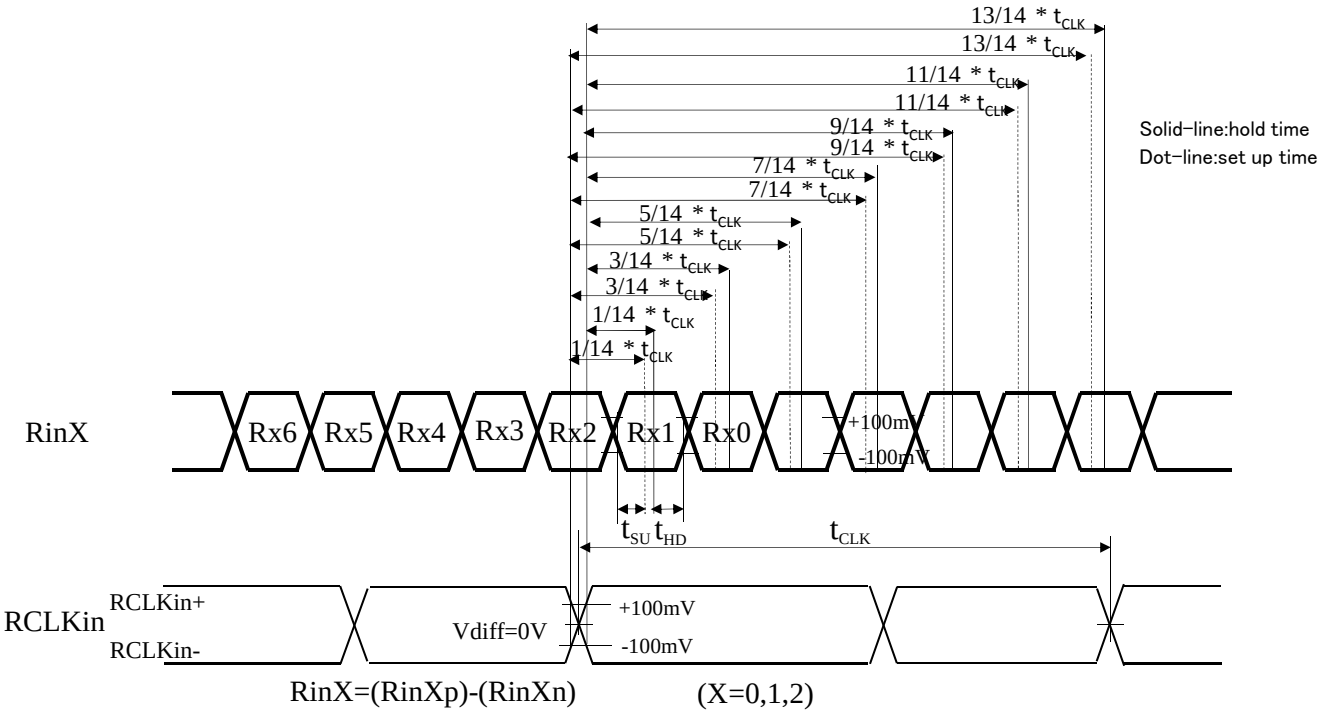
Input deta / Color		R data								G data								B data							
		RA7	RA6	RA5	RA4	RA3	RA2	RA1	RA0	GA7	GA6	GA5	GA4	GA3	GA2	GA1	GA0	BA7	BA6	BA5	BA4	BA3	BA2	BA1	BA0
		RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	GB7	GB6	GB5	GB4	GB3	GB2	GB1	GB0	BB7	BB6	BB5	BB4	BB3	BB2	BB1	BB0
		MSB							LSB	MSB							LSB	MSB							LSB
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

Note 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

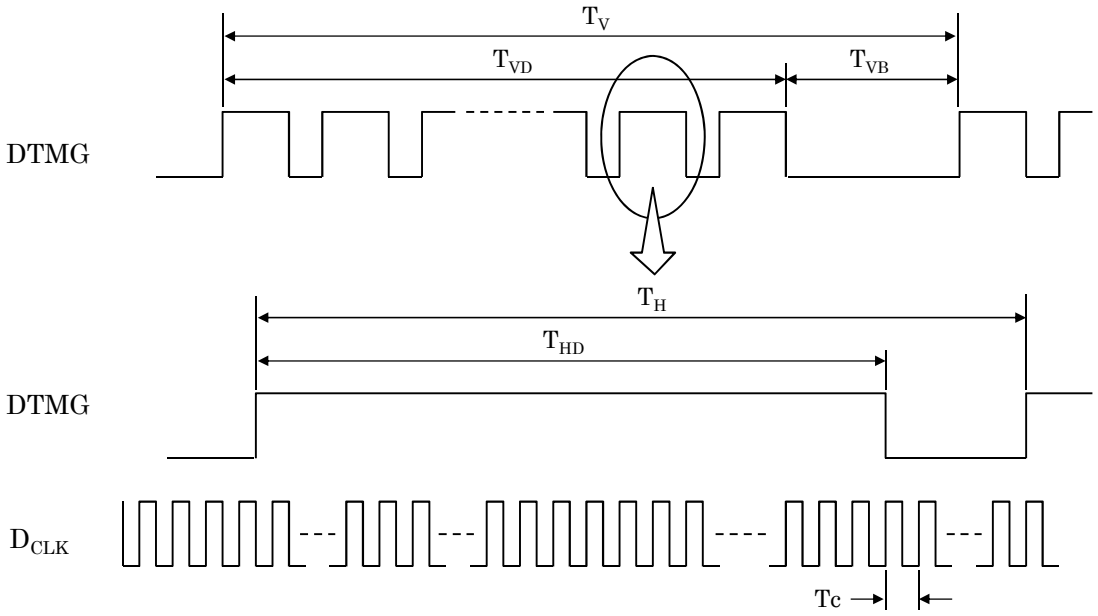
6.1 LVDS RECEIVER TIMING CHARACTERISTICS

(Regulation with the Input Terminal of the Module)



Item		condition	Symbol	Min.	Typ.	Max.	Unit	Remarks
DCLK frequency			$1/t_{CLK}$	40	54	67.5	MHz	
RinX (X=0,1,2)	Set up time	t_{CLK}=15ns	t_{SU}	450	-	-	ps	-
		t_{CLK}=18ns		570	-	-		
		t_{CLK}=25ns		1000	-	-		
	Hold time	t_{CLK}=15ns	t_{HD}	450	-	-		
		t_{CLK}=18ns		570	-	-		
		t_{CLK}=25ns		1000	-	-		

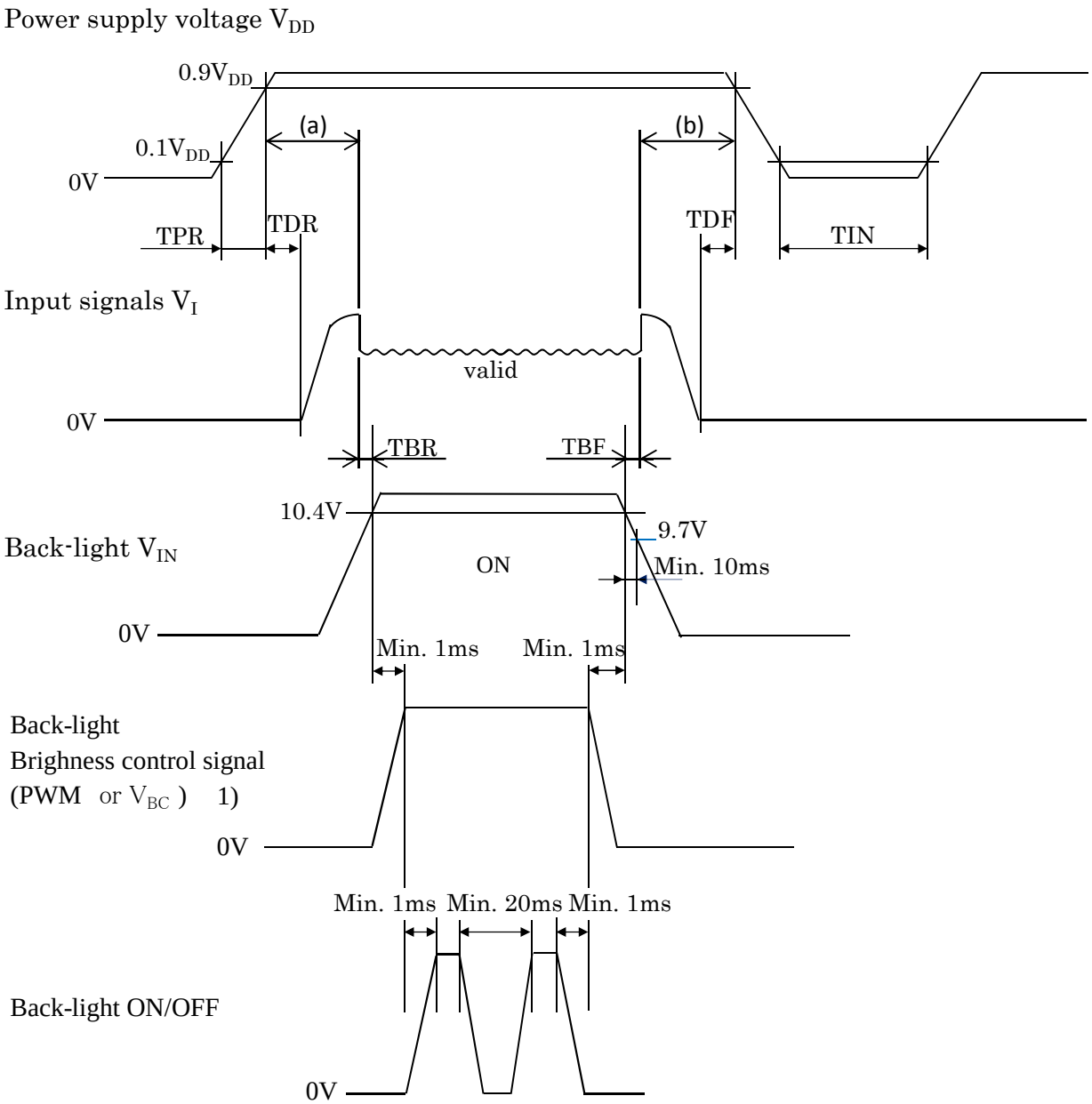
6.2 Timing Parameters



SIGNAL	ITEM	SYMBOL	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	40	—	67.5	MHz	—
Frame Frequency	Cycle	t_V	13.1	16.7	(17.5)	msec	—
			1,027	1,066	(1,270)	lines	—
Vertical Active Display Term	Display Period	t_{VD}	1,024	1,024	1,024	lines	—
	Vertical Blank Period	t_{VB}	3	—	—	lines	—
One Line Scanning Time	Cycle	t_H	812	—	(1,080)	clocks	—
Horizontal Active Display Term	Display Period	t_{HD}	640	640	640	clocks	—

Dimensions in parentheses are reference value.

6.3 TIMING BETWEEN INTERFACE SIGNALS AND POWER SUPPLY



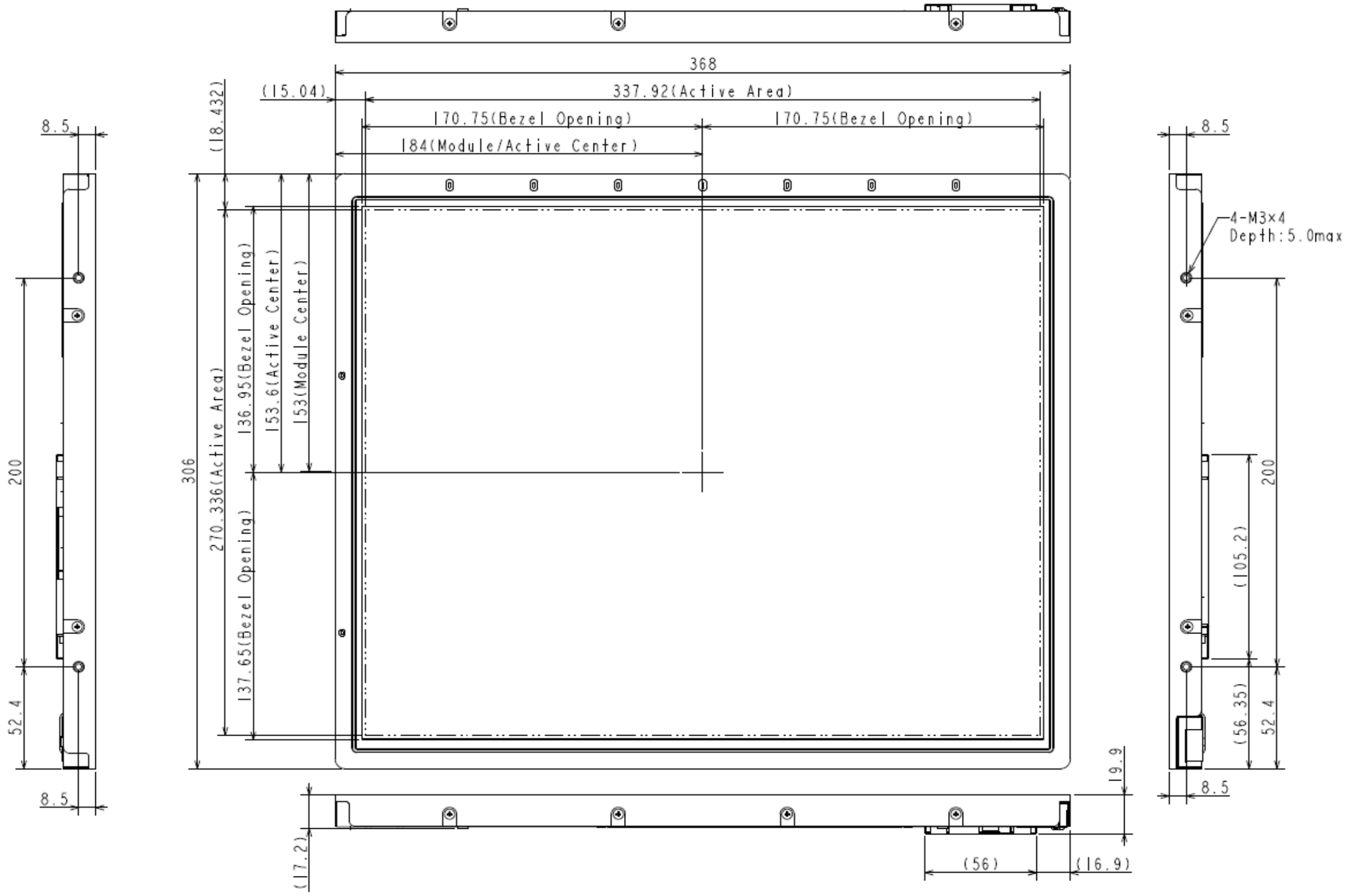
Timing of power supply voltage and input signals should be used under the following specifications.

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

Note 1) These signals can't input at the same time.(Unused pin is to be left open.)

7. DIMENSIONAL OUTLINE

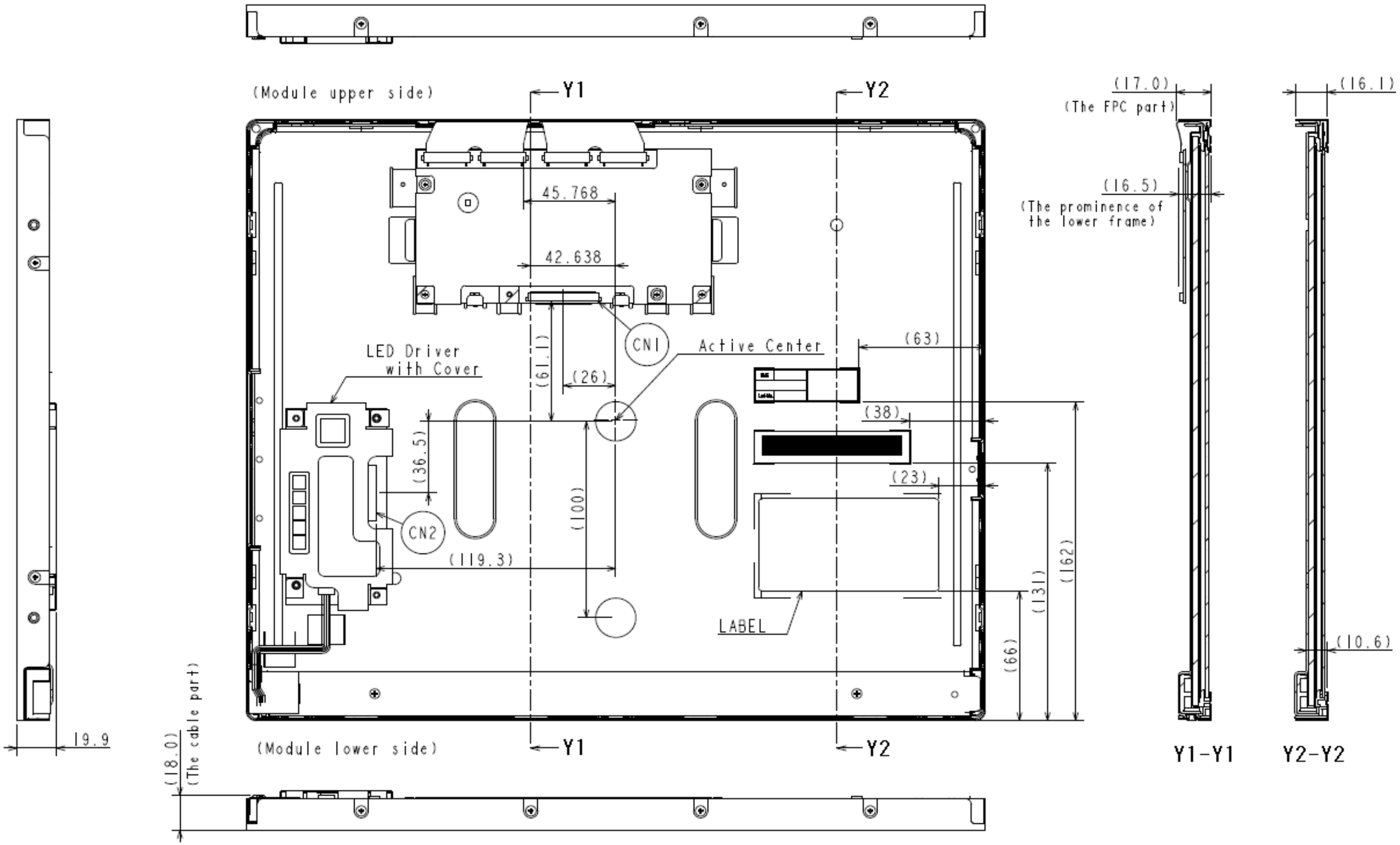
(1)Front View



Note 1) The dimension in parentheses are reference value.
2) The unspecified tolerance: ±0.5mm
3) Measure the thickness with 9.8×10^{4}Pa(1kgf/cm^{2})pressure.
4) Maximum screwing torque for panel mount : 0.392N・m

Unit: mm
Scale:NTS

(2)Rear View



Unit: mm
Scale:NTS

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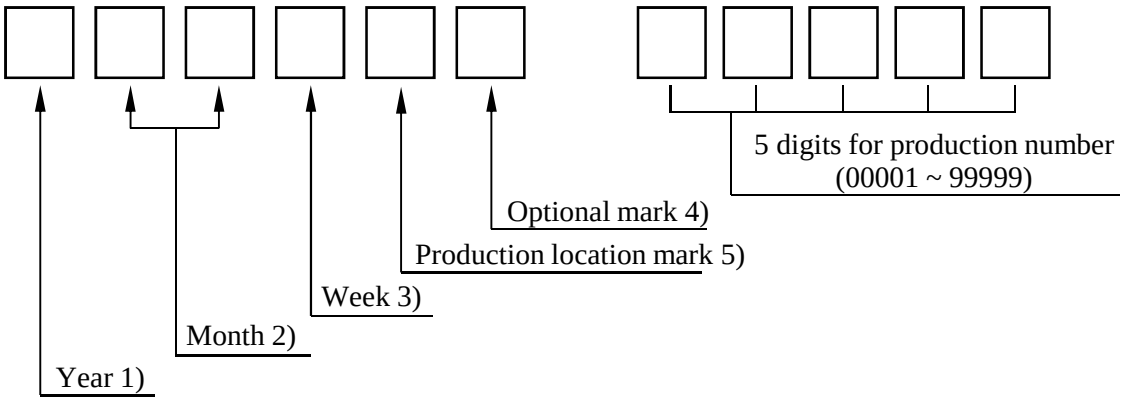
8. DESIGNATION OF LOT MARK

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

4) for Japan Display internal use only.

5)

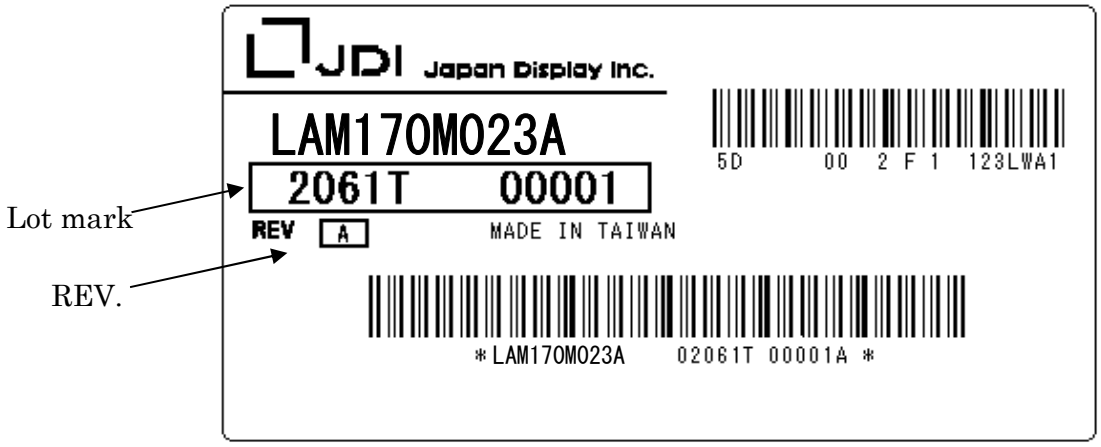
Production management sign	
H	Made in Japan
T	Made in Taiwan

8.2 REVISION (REV.) CONTROL

Revision version is denoted by letter A through Z, except I and O, for Japan Display manufacturing convenience.

8.3 LOCATION OF LOT MARK

The Lot mark is printed on a label which is attached to the rear bezel, as shown in 7. External Dimensional. The style of character can be changed without prior notice.

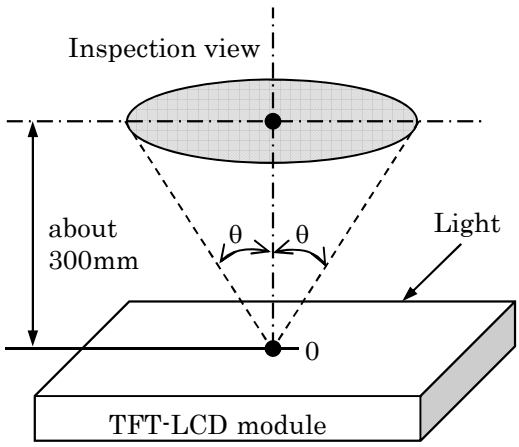


9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

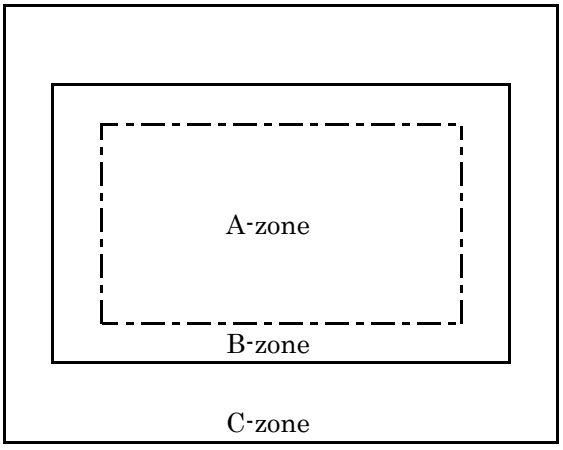
a) The figure shows the correspondence between eyes (of inspector) and TFT-LCD module.
   $\theta < 45°$: when non-operating inspection
   $\theta < 5°$: when operating inspection
b) Inspection should be executed only from front side and only A-zone.
   Cosmetic of B-zone and C-zone are ignore.
   (refer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



(2) Environmental

a) Temperature : 25°C
b) Ambient light : 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

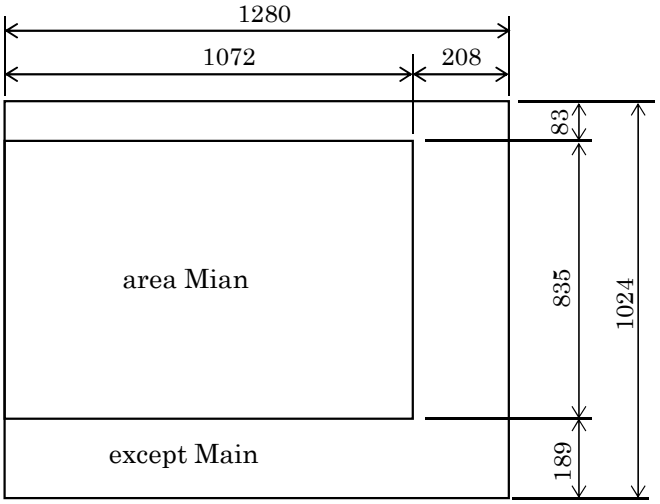
When displaying condition is not stable (ex. at turn on or off), the following specifications are not applied.

	No.	Item				Max. acceptable number A-zone		Unit	Note
Operating inspection	1	Dot Defect	Sparkle mode		Gray Level (S)	Area	Number	Unit	1), 2), 4)
				1-dot	96 ≤ S	Main	0	pcs	
					147 ≤ S	except Main	0		
				2-dots	96 ≤ S	Main	0		
					147 ≤ S	except Main	0		
				3-dots	96 ≤ S	Main	0		
					147 ≤ S	except Main	0		
				4-dots	96 ≤ S	Main	0		
					147 ≤ S	except Main	0		
				Density	96 ≤ S	Main	0	pcs/ϕ15mm	
					147 ≤ S	except Main	0		
			Black mode	1-dot		7		pcs	3), 4)
				2-dots		3		Units	3), 5)
				3-dots		0			
				4-dots		0			
				Density		2		pcs/ϕ15mm	3)
			Total			7		pcs	3)
		Total				7		pcs	—
	2	Line defect				invisible one on all white screen is allowed		—	—
	3	Uneven brightness							
	4	Stain inclusion (Line shape, W: width (mm), L: length (mm))		W ≤ 0.1	L < 1.0	3		pcs	7)
					L ≥ 1.0	0			
	5	Stain inclusion (Dot shape, D: ave. dia. (mm))		D ≤ 0.3		Ignore		pcs	7)
				D ≤ 0.4		4			
				0.4 < D ≤ 0.5		3			
				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	8			
					L > 40	0			
				W ≤ 0.1	L ≤ 10	8			
					L > 10	0			
				W > 0.1	—	0			
	7	Scratch on polarizer (Dot shape, D: ave. dia. (mm))		D ≤ 0.2		Ignore		pcs	8)
				D ≤ 0.6		8			
				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	8		
			D ≤ 1.0	4		
			D > 1.0	0		
	9	Wrinkles on polarizer		invisible one on all white screen is allowed	—	—

Notes 1) Sparkle mode: Brightness of dot is defined in grayscale level. Background brightness level need to be adjusted, which is correspond to each defect intensity level.
Sparkle mode dots below specified brightness level are ignored.

2) Area:



Unit: Pixels width

3) Black mode: brightness of dot is less than 70% at white.
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) Those stains which can be wiped out easily are acceptable.
8) Polarizer area inside of B-zone is not applied.

10. PRECAUTION

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

10.1 PRECAUTION TO HANDLING AND MOUNTING

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

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

(3) The module should be installed with mounting holes of a module. Usage style of this product is limited to landscape mode.

(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.

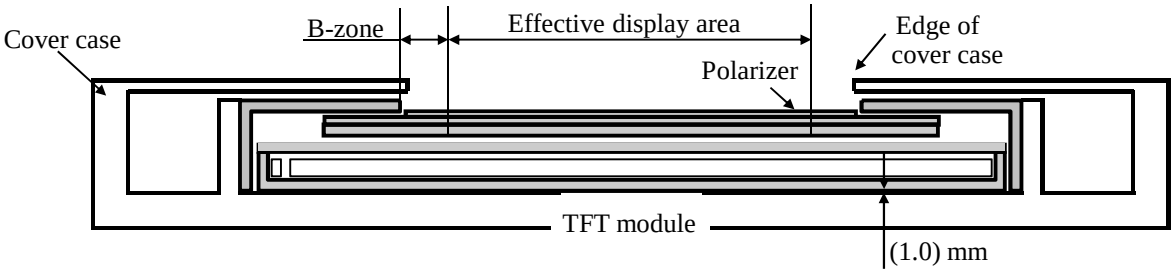


Fig.1 Cross sectional view of a monitor set

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

(7) 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 damage 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 the polarizer becomes dirty it should be gently wiped using an absorbent cotton (Traysee CC clean cloth), chamois or other soft material, slightly dampened with petroleum benzene. 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 portion of a polarizer may become deformed and its color may fade.

(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 Japan Display doesn't guarantee its quality and reliability.
(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's recommended to use clean soft gloves and clean finger stalls whilst the module is handled at incoming inspection process and production assembly process.
(14) 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 this module a mis-operation. The level of spike noise should be as follows: -200mV ≤ over- and under- shoot of VDD ≤ +200mV
VDD including over- and under- shoot should not exceed the absolute maximum ratings.
(3) Optical response time, luminance and chromaticity depend on the temperature of the TFT module. Optical response time becomes longer at lower temperature operation.
(4) Sudden temperature changes may cause dew on and/or in the a module. Dew can cause damage to the polarizer and/or electrical contacting areas of the module. Dew causes deterioration of display quality.
(5) Fixed pattern on display for a long time may cause after-image. It will be recovered soon.
(6) This 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 such interference.
(7) Noise may be heard when a back-light is operated. If necessary, sufficient suppression should be done by the system manufacturers.
(8) The module should not be connected or removed while a main system works.
(9) 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.
(10) In case of using VBC for Brightness Control, Backlight Flickering may be seen caused by electrical noise due to Power Supply Ability.
Please check it with your actual set.

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 a polarizer and color filter 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 direct sunlight or fluorescent light during storage. Modules should be stored between 5 to 35°C at normal humidity (60%RH or less).

(2) The surface of polarizer should not come into direct contact with any other object. It's recommended that modules should be stored in the original Japan Display'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 wristbands. Besides, ionized air should be blown over the module during peeling process. Dusts on a polarizer should be blown off using an ionized nitrogen gun and so on.

10.7 SAFETY

(1) Since the TFT cell is made of glass, handling of any broken module 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 ENVIRONMENTAL PROTECTION

(1) 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 Jpan Display 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 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.