Panasonic Liquid Crystal Display Co.,Ltd.

TECHNICAL DATA

VVX31P163H01

CONTENTS

RECORD OF REVISION

Date	The upper section : Previous revision The lower section : New revision		Summary
	Sheet No.	Page	

DESCRIPTION

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

Product Name : VVX31P163H01

Product Factory : Panasonic Liquid Crystal Display Co., Ltd.

General Specifications

Effective display area	: (H) 697.958 × (V) 368.064	(mm)
Number of pixels	: (H) 4,096 × (V) 2,160	(pixels)
Pixel pitch	: (H) 0.1704 × (V) 0.1704	(mm)
Color pixel arrangement	: B+G+R vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Anti-Glare	
Number of colors	: 1,073,741,824	(colors)
Viewing angle range	: Super wide version (Horizontal & Vertical : 178°, CR≧10)	
Input signal	: 8ch-LVDS (LVDS : Low voltage differential signaling)	
Backlight	: Edge LED type (LED : Light-emitting diode)	
External dimensions	: Typ. (H) 725.9 × (V) 401.6 × (T)28.5	(mm)
Weight	: Typ. 4,400	(g)

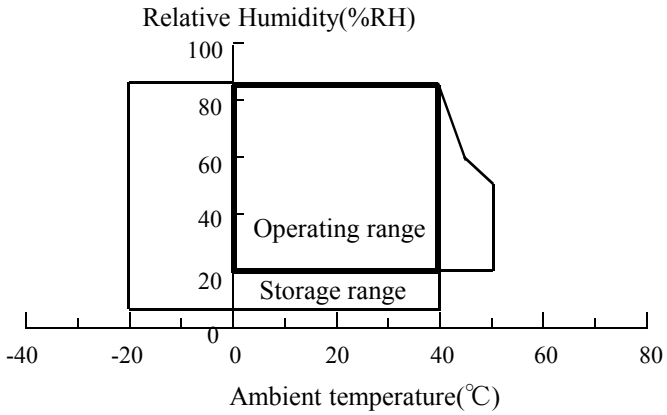
1. ABSOLUTE MAXIMUM RATINGS

1. 1 Environmental Absolute Maximum Ratings

ITEM	Operating		Storage		UNIT	NOTE
	Min.	Max.	Min.	Max.		
Temperature	0	40	-20	50	℃	1),6)
Humidity	2)		2)		%RH	1)
Vibration	-	4.9 (0.5 G)	-	14.7 (1.5 G)	m/s^2	3),4)
Shock	-	29.4 (3 G)	-	294 (30 G)	m/s^2	4),5)
Corrosive Gas	Not Acceptable		Not Acceptable		-	
Illumination at LCD Surface	-	50,000	-	50,000	1x	
Altitude	-	5,000	-	13,600	m	7)

Note 1) Temperature and Humidity should be applied to the glass surface of a IPS-Pro TFT LCD module, not to the system installed with a module.

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



3) Frequency of the vibration is between 15 Hz and 100 Hz. (Remove the resonance point) 1 hour.

4) Direction : ±X, ±Y, ±Z (One time each direction)

5) Pulse width of the shock is 10 ms.

6) The temperature of LCD front surface would be 65 ℃ in operating, it may affect the optical characteristics however it does not damage the function of the module.

7) It may affect the optical characteristics. However it does not damage the function of the module.

8) Maximum Storage Humidity is up to 40℃, 70% RH only for 4 corner light leakage Mura.

1. 2 Electrical Absolute Maximum Ratings

(1)TFT-LCD module Vss = 0V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Power Supply Voltage	V_{DD}	0	13.2	V	
Input Voltage for LVDS	V_I	-0.3	4.0	V	1)

Note 1) It is applied to pixel data signal, clock signal and other control signals.

(2) Back light unit Vss = 0V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Input voltage	V_{in}	0	27.0	V	
ON/OFF control input voltage	ON/OFF	-0.3	5.5	V	
PWM signal voltage	V_{pwm}	-0.3	5.5	V	

2. INITIAL OPTICAL CHARACTERISTICS

The following optical characteristics are measured under stable conditions. It takes about 60 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.

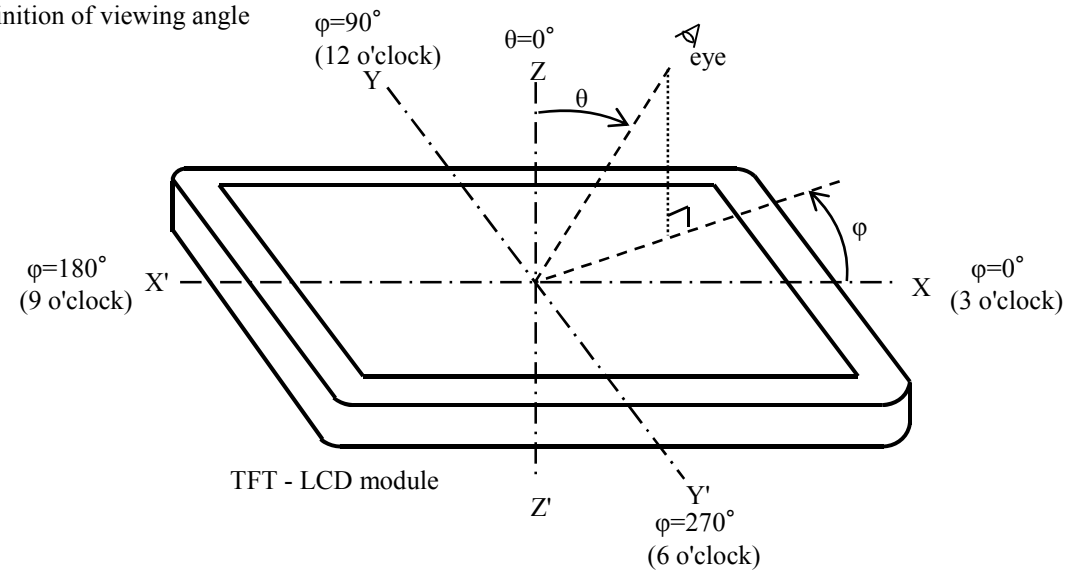
Measuring equipment : CS-2000A, or equivalent

Ambient Temperature =25 ℃ ,V_{DD}=12.0 V , f V=60 Hz ,

LEDIf=61mA , duty = 100 %

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast ratio		CR	θ= 0 ° 1)	1000	1500	-	-	2)
Response time	Rise	ton		-	11	20	ms	3)
	Fall	toff		-	9	20	ms	3)
Brightness of white		Bwh		420	525	-	cd/m^2	
Brightness uniformity		Buni		-	-	25	%	4)
Color chromaticity (CIE)	Red	x		0.652	0.682	0.712	-	【Gray scale =1024】
		y		0.287	0.317	0.347		
	Green	x		0.232	0.262	0.292		
		y		0.643	0.673	0.703		
	Blue	x		0.121	0.151	0.181		
		y		0.012	0.042	0.072		
	White	x		0.283	0.313	0.343		
		y		0.299	0.329	0.359		
Variation of color position (CIE)	Red	Δx	θ= 50 ° φ= 0 °, 90 °, 180 °, 270 ° 1)	-	-	0.04	-	5) 【Gray scale =1024】
		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 89 °		CR89	6)	10	-	-	-	Estimated value
Image sticking		-	Mosaic pattern	Invisible			-	7)
γ		-	-	-	2.2	-	-	

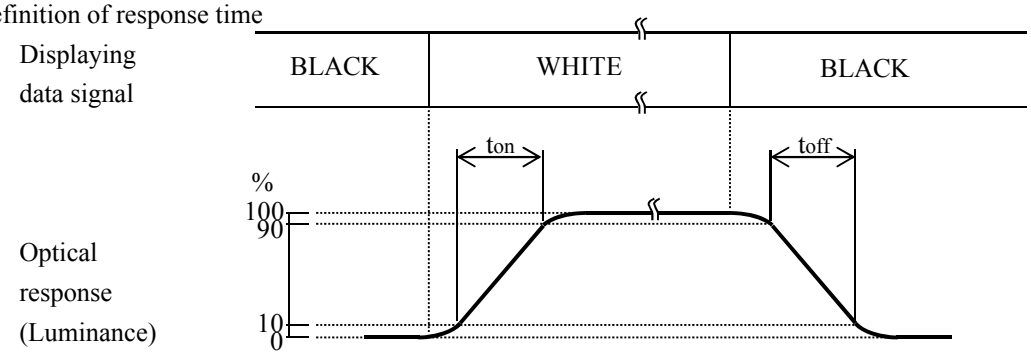
Note 1) Definition of viewing angle



Note 2) Definition of contrast ratio (CR)

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

3) Definition of response time



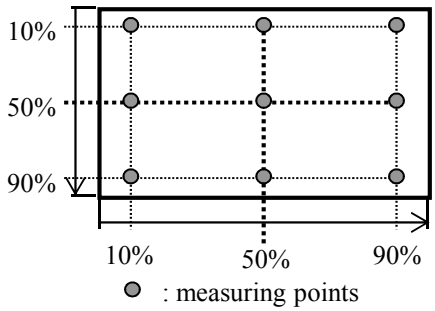
4) Definition of brightness uniformity

Display pattern is white (1023 level) . The brightness uniformity is defined as the following equation. Brightness at each point is measured, and average, maximum and minimum brightness is calculated.

$$Buni = \frac{Bmax - Bmin}{Bmax} \times 100$$

where, $Bmax$ = Maximum brightness

$Bmin$ = Minimum brightness



5) Variation of color position on CIE

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

6) Contrast ratio at 89 °

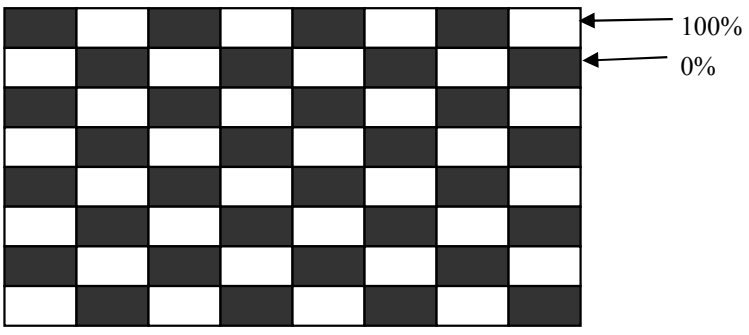
Evaluation conditions are on horizontal & vertical axis.

7) Image sticking

Condition : Operating mosaic pattern for 2 hours and gray (512/1024 Gray Scale) for 30seconds.

Operating mosaic pattern for 8 hours and gray (512/1024 Gray Scale) for 10minutes.

Mosaic pattern



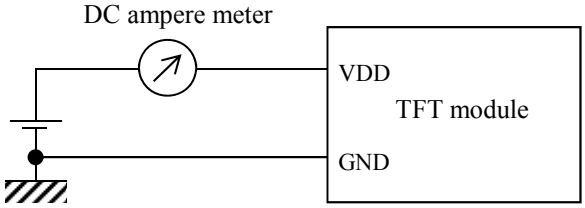
3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

Ta = 25 ℃ , GND = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage		VDD	11.4	12.0	12.6	V	
Power supply current		IDD	-	1.8	2.2	A	1)
Ripple voltage of power supply		VDDR	-	-	500	mV	
Logic signals input voltage	High	VIH	3.0	3.3	3.6	V	LVDSSEL(10k-ohm pull down)
	Low	VIL	0	0	0.6	V	

Note 1) fV=60.0Hz, DCLK=75MHz, VDD=12.0V, and display pattern is white.



3. 2 Back light unit

Ta = 25 ℃ , GND = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Input voltage		Vin	21.6	24.0	26.4	V	
Input current		Iin	-	2.40	-	A	PWM on-duty=100% Vin=24V
ON/OFF Control voltage	ON	ON/OFF	2.0	-	5.0	V	1MΩ pull down
	OFF		-0.3	-	0.8		
PWM signal	High	Vpwm	2.0	-	5.0	V	2MΩ pull down
	Low		-0.3	-	0.8		
PWM frequency		-	90	360	480	Hz	3)
On-duty range for burst-dimming		On-duty	5	-	100	%	
LED Life time		-	30,000	-	-	hours	2)

One Backlight Unit :4 PCBbar

One PCB board :3 LED String

One LED String : 11 LED package

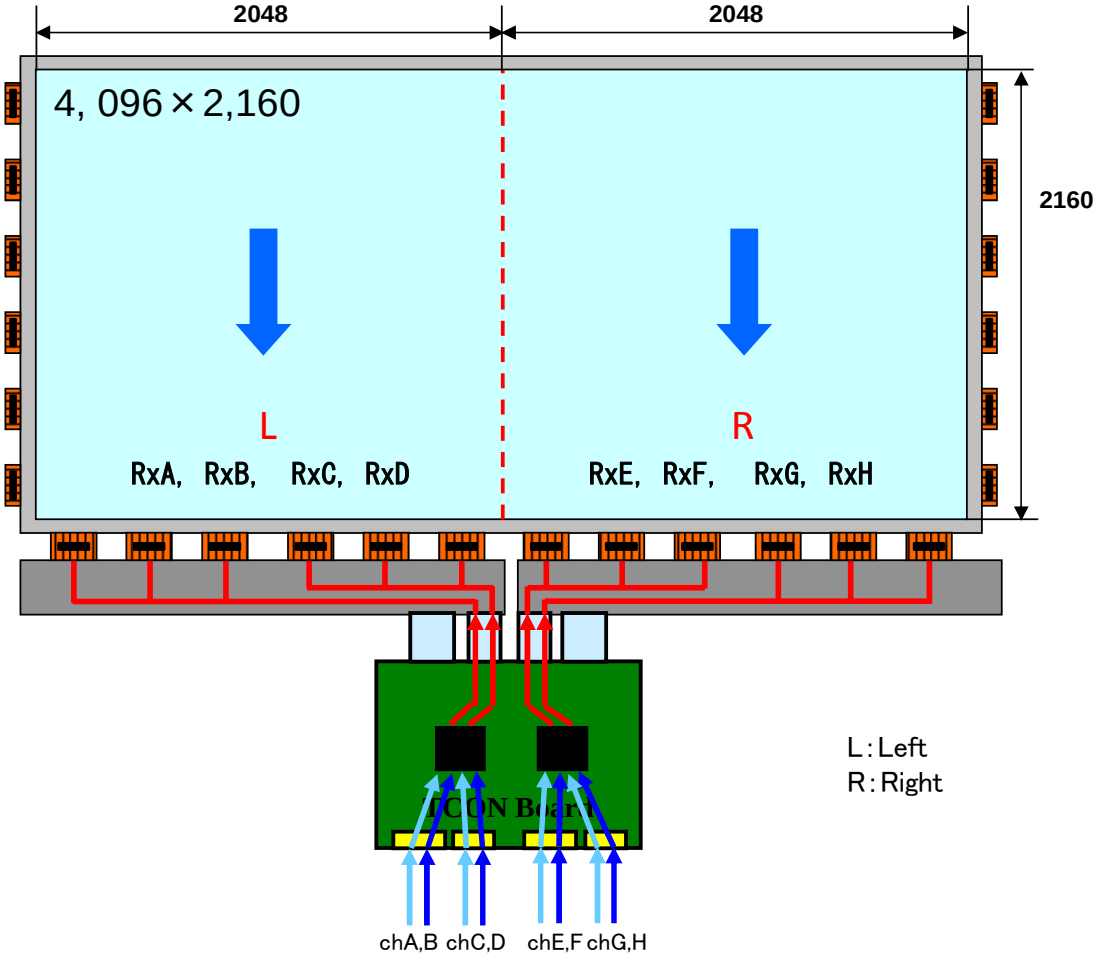
Note 1) This characteristics should be applied putting on the LED about 60 minutes later with ambient temperature. (Ta = 25 ℃ ± 2 ℃)

2) Life time of a LED is defined as the time at which brightness of the LED is 50 % compared to that of initial value at that typical LED current on condition of continuous operating at 25 ± 2 ℃.

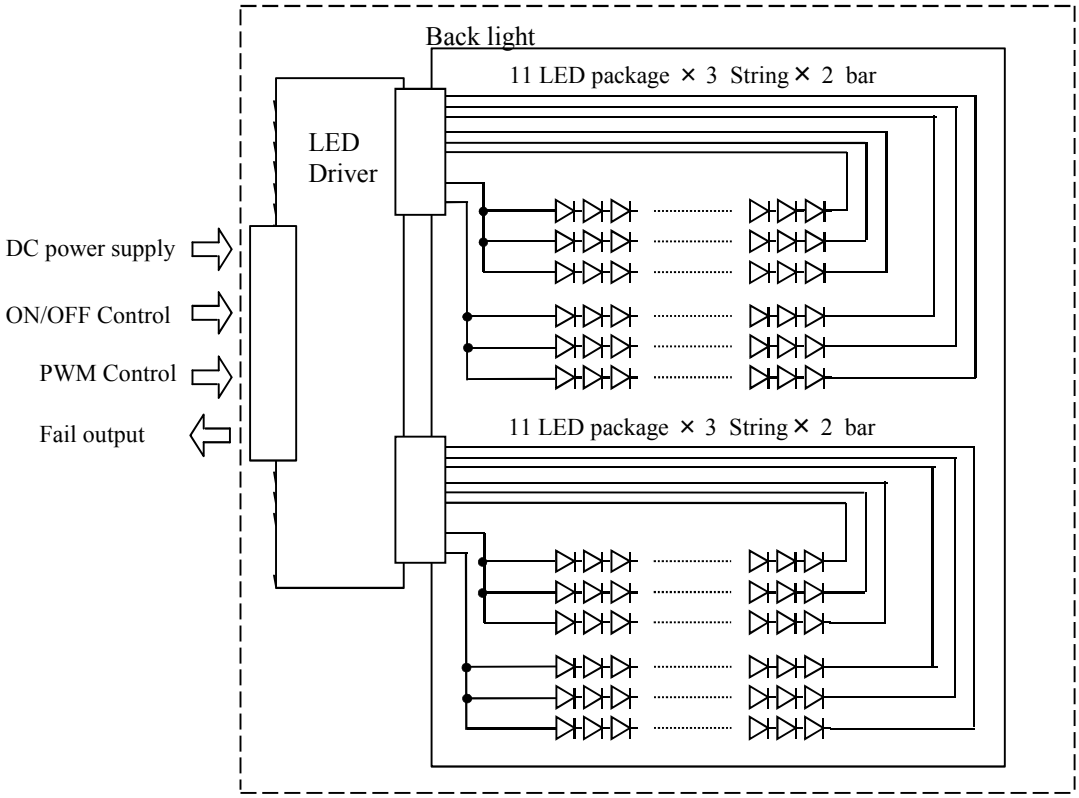
3) Please be synchronized PWM signal with LVDS to avoid beat noise, and residual of the light.

4. BLOCK DIAGRAM

4. 1 TFT-LCD module



4. 2 Backlight unit



5. INTERFACE PIN ASSIGNMENT

5. 1 TFT-LCD module

<CN1:JAE FI-RNE51SZ-HF-R1500>

(Matching with JAE FI-R51-HL,FE-RE51-HL)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	GND	Ground	-	2)
2	I.C.	Internally Connection (keep open)	-	
3	I.C.	Internally Connection (keep open)	-	
4	I.C.	Internally Connection (keep open)	-	
5	I.C.	Internally Connection (keep open)	-	
6	I.C.	Internally Connection (keep open)	-	
7	LVDSSEL	LVDS Format Select	I	4) 5)
8	N.C.	No Connection (keep open)	-	
9	I.C.	Internally Connection (keep open)	-	
10	I.C.	Internally Connection (keep open)	-	
11	GND	Ground	-	2)
12	RxA0-	chA (L 1st-pixel) Data	I	3)
13	RxA0+			
14	RxA1-			
15	RxA1+			
16	RxA2-			
17	RxA2+			
18	GND	Ground	-	2)
19	CLKA-	chA (L 1st-pixel) Clock	I	3)
20	CLKA+			
21	GND	Ground	-	2)
22	RxA3-	chA (L 1st-pixel) Data	I	3)
23	RxA3+			
24	RxA4-			
25	RxA4+			
26	GND	Ground	I	2)
27	GND			

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
28	RxB0-	chB (L 2nd-pixel) Data	I	3)
29	RxB0+			
30	RxB1-			
31	RxB1+			
32	RxB2-			
33	RxB2+			
34	GND	Ground	-	2)
35	CLKB-	chB (L 2nd-pixel) Clock	I	3)
36	CLKB+			
37	GND	Ground	-	2)
38	RxB3-	chB (L 2nd-pixel) Data	I	3)
39	RxB3+			
40	RxB4-			
41	RxB4+			
42	GND	Ground	-	2)
43	GND			
44	GND			
45	GND			
46	GND			
47	N.C.	No Connection (keep open)	-	
48	VLCD	Power supply (+12V)	I	1)
49	VLCD			
50	VLCD			
51	VLCD			

Note 1) All V_{LCD} pins shall be connected to +12.0V(Typ.).

2) All GND pins shall be grounded. Metal bezel is internally connected to GND.

3) Rxmn+/- and CLKm+/-(m=A,B)(n=0,1,2,3,4) should be wired by twist-pairs.

4) See 5.3

5) 10KΩ pull down

<CN2:JAE FI-RNE41SZ-HF-R1500>

(Matching with JAE FI-R41-HL,FE-RE41-HL)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	N.C.	No Connection (keep open)	-	
2	VLCD	Power supply (+12V)	I	1)
3	VLCD			
4	VLCD			
5	VLCD			
6	GND	Ground	-	2)
7	GND			
8	GND			
9	GND			
10	RxC0-	chC (L 3rd-pixel) Data	I	3)
11	RxC0+			
12	RxC1-			
13	RxC1+			
14	RxC2-			
15	RxC2+			
16	GND	Ground	-	2)
17	CLKC-	chC (L 3rd-pixel) Clock	I	3)
18	CLKC+			
19	GND	Ground	-	2)
20	RxC3-	chC (L 3rd-pixel) Data	I	3)
21	RxC3+			
22	RxC4-			
23	RxC4+			
24	GND	Ground	I	2)
25	GND			

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
26	RxD0-	chD (L 4th-pixel) Data	I	3)
27	RxD0+			
28	RxD1-			
29	RxD1+			
30	RxD2-			
31	RxD2+			
32	GND	Ground	-	2)
33	CLKD-	chD (L 4th-pixel) Clock	I	3)
34	CLKD+			
35	GND	Ground	-	2)
36	RxD3-	chD (L 4th-pixel) Data	I	3)
37	RxD3+			
38	RxD4-			
39	RxD4+			
40	GND	Ground	I	2)
41	GND			

Note 1) All V_{LCD} pins shall be connected to +12.0V(Typ.).

2) All GND pins shall be grounded. Metal bezel is internally connected to GND.

3) Rxmn+/- and CLKm+/-(m=C,D)(n=0,1,2,3,4) should be wired by twist-pairs.

<CN3:JAE FI-RNE51SZ-HF-R1500>

(Matching with JAE FI-R51-HL,FE-RE51-HL)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	GND	Ground	-	2)
2	N.C.	No Connection (keep open)	-	
3	N.C.	No Connection (keep open)	-	
4	I.C.	Internally Connection (keep open)	-	
5	I.C.	Internally Connection (keep open)	-	
6	I.C.	Internally Connection (keep open)	-	
7	N.C.	No Connection (keep open)	-	
8	N.C.	No Connection (keep open)	-	
9	I.C.	Internally Connection (keep open)	-	
10	I.C.	Internally Connection (keep open)	-	
11	GND	Ground	-	2)
12	RxE0-	chE (R 1st-pixel) Data	I	3)
13	RxE0+			
14	RxE1-			
15	RxE1+			
16	RxE2-			
17	RxE2+			
18	GND	Ground	-	2)
19	CLKE-	chE (R 1st-pixel) Clock	I	3)
20	CLKE+			
21	GND	Ground	-	2)
22	RxE3-	chE (R 1st-pixel) Data	I	3)
23	RxE3+			
24	RxE4-			
25	RxE4+			
26	GND	Ground	-	2)
27	GND			

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
28	RxF0-	chF (R 2nd-pixel) Data	I	3)
29	RxF0+			
30	RxF1-			
31	RxF1+			
32	RxF2-			
33	RxF2+			
34	GND	Ground	-	2)
35	CLKF-	chF (R 2nd-pixel) Clock	I	3)
36	CLKF+			
37	GND	Ground	-	2)
38	RxF3-	chF (R 2nd-pixel) Data	I	3)
39	RxF3+			
40	RxF4-			
41	RxF4+			
42	GND	Ground	-	2)
43	GND			
44	GND			
45	GND			
46	GND			
47	N.C.	No Connection (keep open)	-	
48	VLCD	Power supply (+12V)	I	1)
49	VLCD			
50	VLCD			
51	VLCD			

Note 1) All V_{LCD} pins shall be connected to +12.0V(Typ.).

2) All GND pins shall be grounded. Metal bezel is internally connected to GND.

3) Rxmn+/- and CLKm+/-(m=E,F)(n=0,1,2,3,4) should be wired by twist-pairs.

<CN4:JAE FI-RNE41SZ-HF-R1500>

(Matching with JAE FI-R41-HL,FE-RE41-HL)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	N.C.	No Connection (keep open)	-	
2	VLCD	Power supply (+12V)	I	1)
3	VLCD			
4	VLCD			
5	VLCD			
6	GND	Ground	-	2)
7	GND			
8	GND			
9	GND			
10	RxG0-	chG (R 3rd-pixel) Data	I	3)
11	RxG0+			
12	RxG1-			
13	RxG1+			
14	RxG2-			
15	RxG2+			
16	GND	Ground	-	2)
17	CLKG-	chG (R 3rd-pixel) Clock	I	3)
18	CLKG+			
19	GND	Ground	-	2)
20	RxG3-	chG (R 3rd-pixel) Data	I	3)
21	RxG3+			
22	RxG4-			
23	RxG4+			
24	GND	Ground	−	2)
25	GND			

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
26	RxH0-	chH (R 4th-pixel) Data	I	3)
27	RxH0+			
28	RxH1-			
29	RxH1+			
30	RxH2-			
31	RxH2+			
32	GND	Ground	-	2)
33	CLKH-	chH (R 4th-pixel) Clock	I	3)
34	CLKH+			
35	GND	Ground	-	2)
36	RxH3-	chH (R 4th-pixel) Data	I	3)
37	RxH3+			
38	RxH4-			
39	RxH4+			
40	GND	Ground	−	2)
41	GND			

Note 1) All V_{LCD} pins shall be connected to +12.0V(Typ.).

2) All GND pins shall be grounded. Metal bezel is internally connected to GND.

3) Rxmn+/- and CLKm+/-(m=G,H)(n=0,1,2,3,4) should be wired by twist-pairs.

LED Driver IF

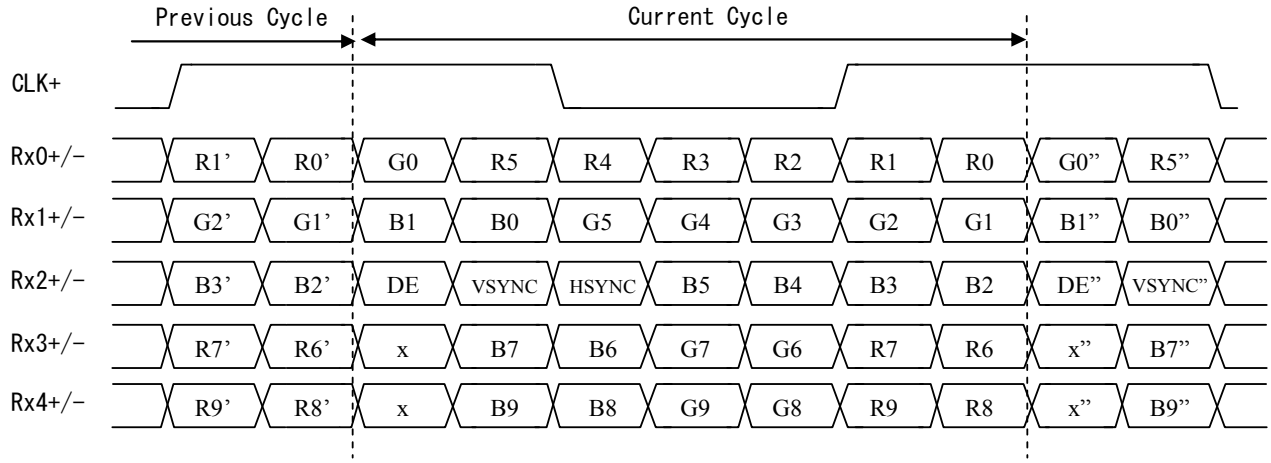
CN1:JST S14B-PHA-SM-TB(LF)

(Matching connector : JST PHA Connector)

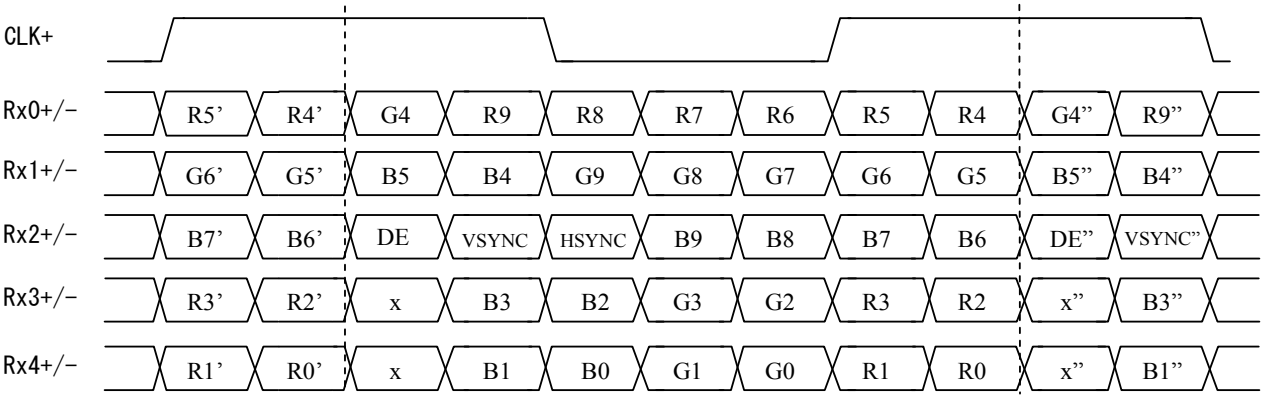
PINNo.	SYMBOL	DESCRIPTION	I/O	NOTE
1	Vin	Power supply (+24V)	-	1)
2	Vin			
3	Vin			
4	Vin			
5	Vin			
6	GND	Ground	-	2)
7	GND			
8	GND			
9	GND			
10	GND			
11	Fail	Error Out	O	3)
12	ON/OFF	BackLight On/Off Control	I	4), 6)
13	N.C.(A-DIM)	No Connection	-	
14	PWM	External PWM dimming	I	5), 7)

1) All V_{BL} pins shall be connected to +24.0V(Typ.).
2) All GND pins shall be grounded. Metal bezel is internally connected to GND.
3) Normal state: 0～0.8V Abnormal state:Open drain output IoL(max.):4mA
4) High : LED Back Light On. Low : LED Back Light Off.
5) High : LED Back Light On. Low : LED Back Light Off.
6) 1MΩ pull down
7) 2MΩ pull down

5. 3 LVDS format



VESA LVDSSEL(CN1 #7) = Low



JEIDA LVDSSEL(CN1 #7) = High

DE : Data Enable
VSYNC : Vertical SYNC
HSYNC : Horozontal SYNC
x : don't care

MSB LSB
R9 --- R0 : Red Data
G9 --- G0 : Green Data
B9 --- B0 : Blue Data

5. 4 Relationship between display colors and input signals

Color \ Input		Red Data										Green Data										Blue Data									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	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	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	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	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	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	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	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	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	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	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	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	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	Blue (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

Note 1) Definition of gray scale :

Color(n)・・・・Number in parenthesis indicates gray scale level.

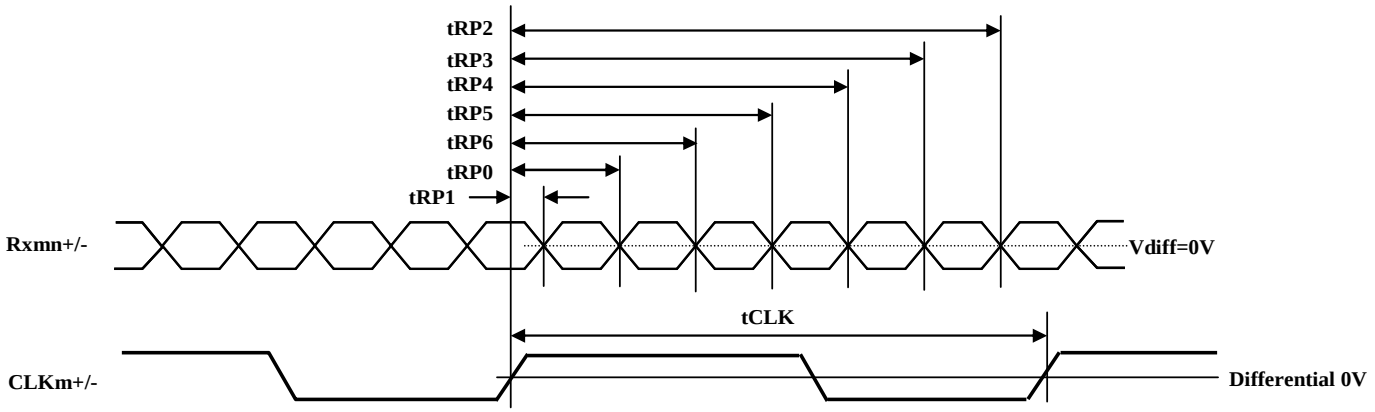
Larger n corresponds to brighter level.

2) Data : 1 : High, 0 : Low

6. INTERFACE TIMING

6. 1 LVDS receiver timing

6.1.1 AC Characteristics



m : A - H

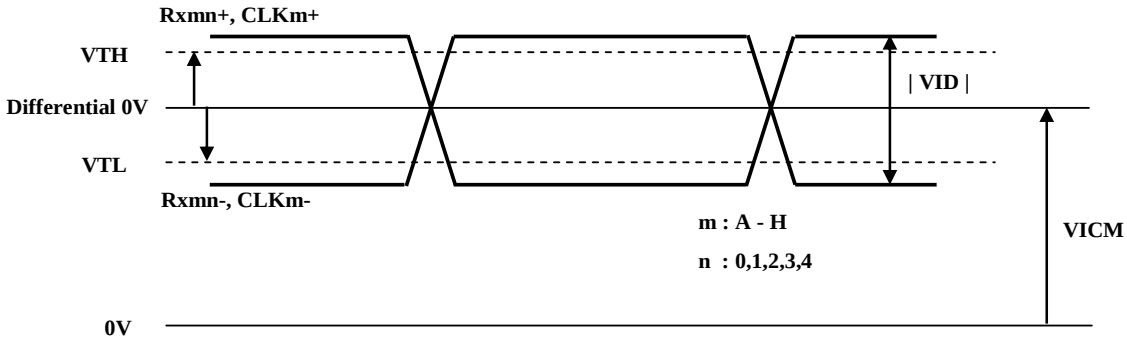
n : 0,1,2,3,4

Symbol	Parameter	Min.	Typ.	Max.	Unit
tCLK	CLK Period	13.36	13.47	17.02	ns
tRP1	Input data Position0	-0.45	0.0	-0.45	ns
tRP0	Input data Position1	tCLK * 1/7 - 0.45	tCLK * 1/7	tCLK * 1/7 + 0.45	ns
tRP6	Input data Position2	tCLK * 2/7 - 0.45	tCLK * 2/7	tCLK * 2/7 + 0.45	ns
tRP5	Input data Position3	tCLK * 3/7 - 0.45	tCLK * 3/7	tCLK * 3/7 + 0.45	ns
tRP4	Input data Position4	tCLK * 4/7 - 0.45	tCLK * 4/7	tCLK * 4/7 + 0.45	ns
tRP3	Input data Position5	tCLK * 5/7 - 0.45	tCLK * 5/7	tCLK * 5/7 + 0.45	ns
tRP2	Input data Position6	tCLK * 6/7 - 0.45	tCLK * 6/7	tCLK * 6/7 + 0.45	ns

6.1.2 SSC

	Unit	Min.	Typ	Max.	Note
Modulation frequency	kHz	0	-	200	
Modulation rate	%	-2	-	+2	
Modulation profile	-	Triangle wave			

6.1.3 DC Characteristics



Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
VTH	Differential Input High Threshold	VICM = 1.2V	-	-	100	mV
VTL	Differential Input Low Threshold	VICM = 1.2V	-100	-	-	mV
| VID |	Input Differential Voltage		100	400	600	mV
RPD	Pull-down resistor (including 100 ohm resistor) (*1)		20	23	26	kohm
VICM	Differential Input Common Mode Voltage		0.6	1.2	2.4 - | VID | / 2	V

NOTES : 1. Please refer to Figure RPD

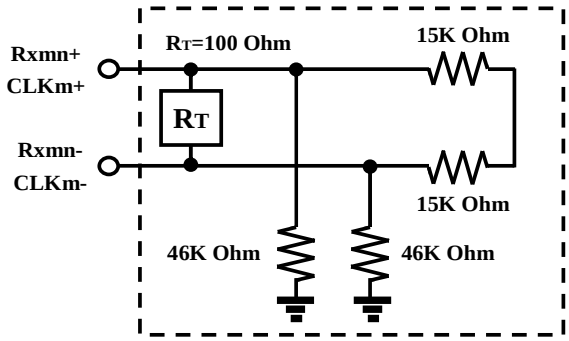
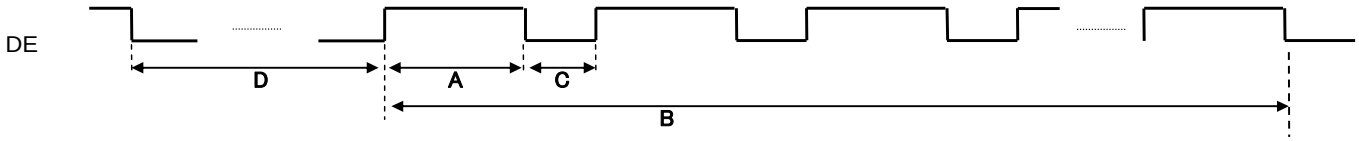
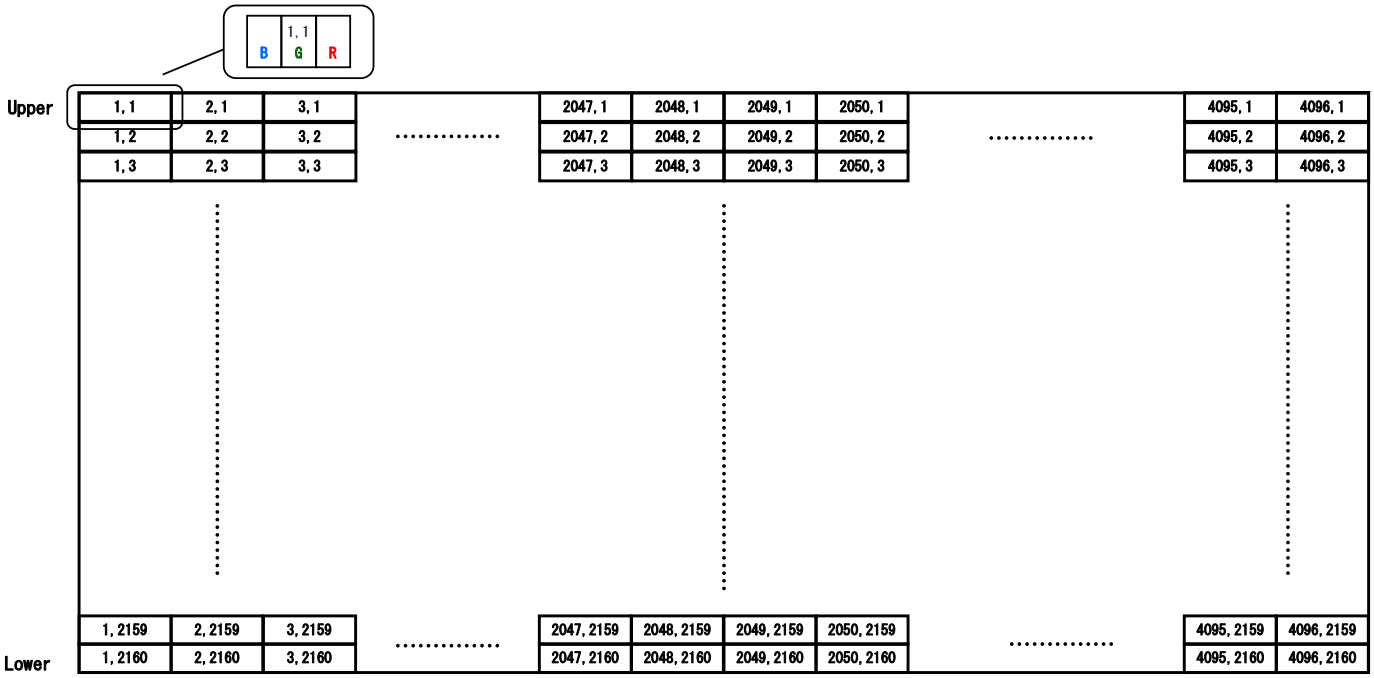


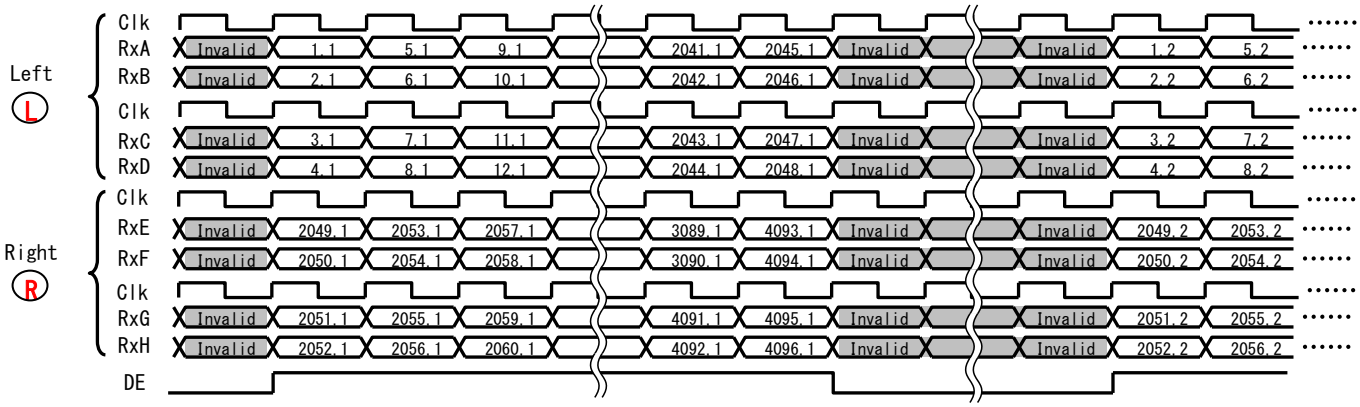
Figure RPD



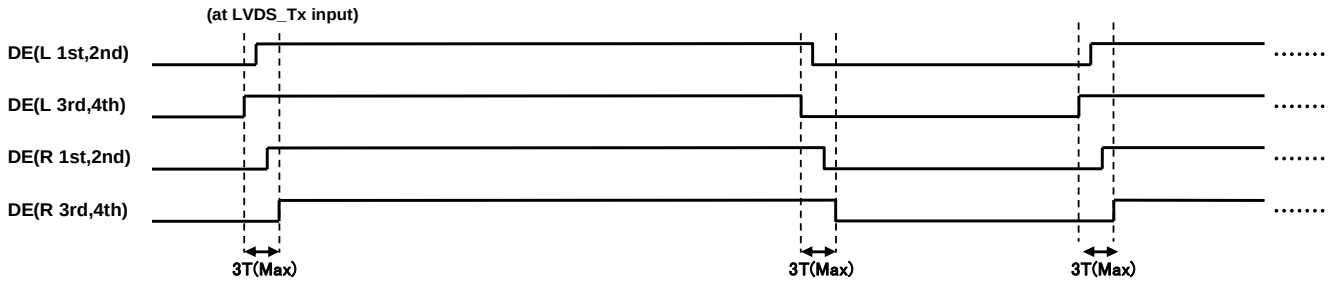
	Unit	Min.	Typ.	Max.	Note
Horizontal Active (A)	clk		512		
Vertical Active (B)	H		2160		
Horizontal Blanking (C)	clk	12	56	64	
Vertical Blanking (D)	H	5	18	22	
Pixel Clock	MHz	58.76	74.20	74.85	
Horizontal Frequency (A+C)	kHz	103.46	130.7	132.01	
Vertical Frequency (B+D)	Hz	47.5	60	60.5	*1)

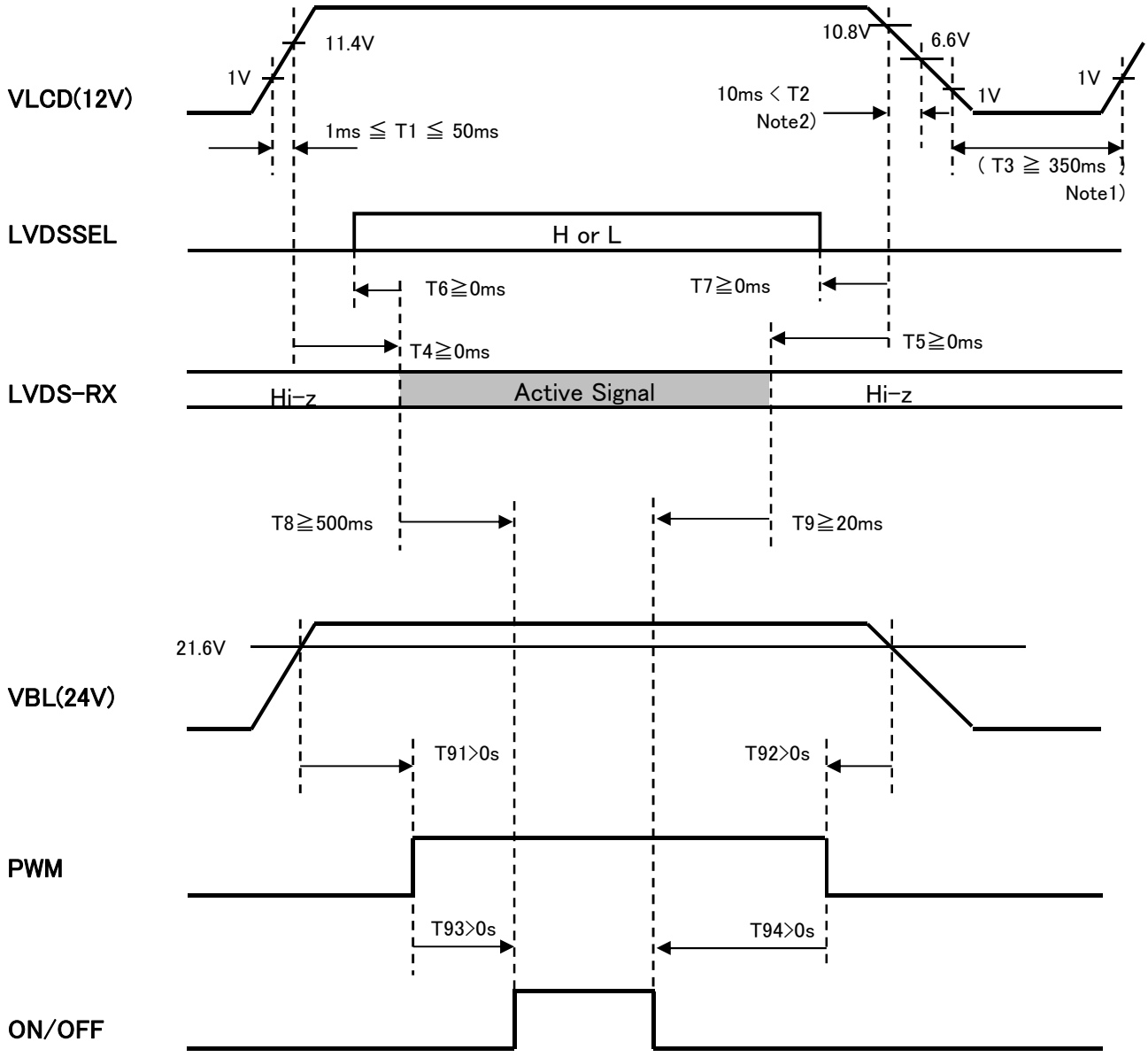
*1) In case of under 50Hz, Flicker is concerned. Please evaluation sufficiently.





Permission Delay of Sync Timing**(Data Enable)**





Note

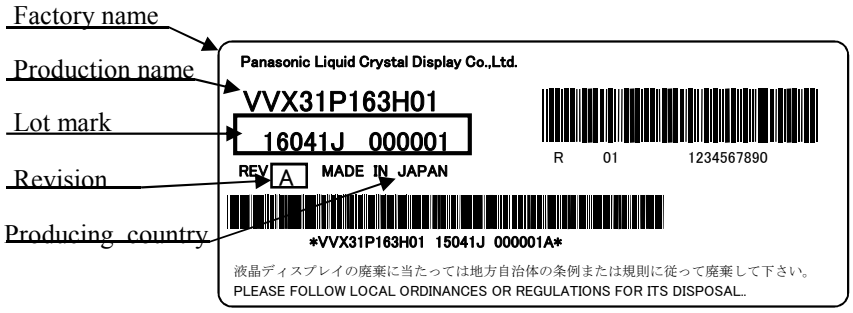
1) There is a case that afterimage can be seen if this specification is not followed. However, as long as the afterimage can be allowed, it is tolerated.
2) If T2 is shorter than the minimum specification,abnormal display might be shown. However there is no melfunction.

7. LABEL FORMAT

7.1 Label

The label is on the metallic bezel as shown in 11. External Dimensional.

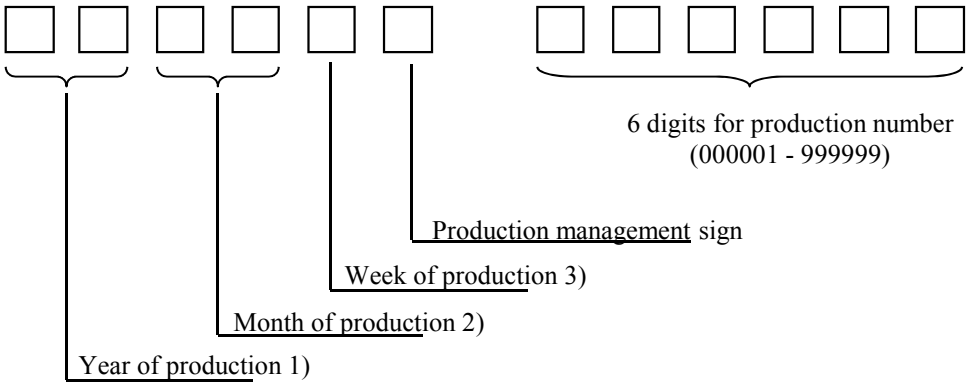
The style of character will be changed without notice.



7.2 Revision (REV.) control

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

7.3 Lot mark



Notes 1)

Mark	Year
18	2018
19	2019
20	2020
21	2021
22	2022

2)

Mark	Month	Mark	Month
01	1	07	7
02	2	08	8
03	3	09	9
04	4	10	10
05	5	11	11
06	6	12	12

3)

Week mark	Day
1	1～7
2	8～14
3	15～21
4	22～28
5	29～31

7.4 Record of revision described on the label

Mark	Added the tape for dust	
	Before	After
A	○	－
B	－	○

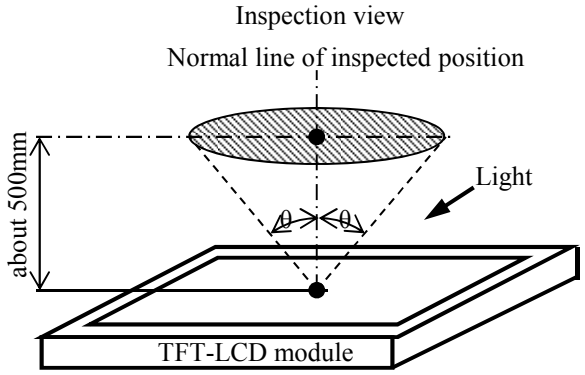
8. COSMETIC SPECIFICATIONS(31.1inch)

8.1 Condition 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≦45° : 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 8.2 Definition of zone)



(2) Environmental

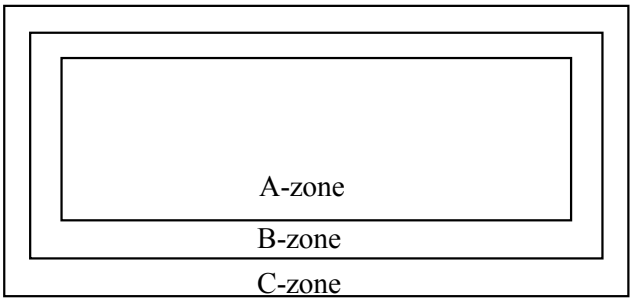
a) Temperature : 25 degrees C

b) Ambient light : about 100 lx and non-directive when operating inspection.
: about 1000 lx and non-directive when non-operating inspection.

c) Backlight : when non-operating inspection, backlight should be off .

8.2 Definition of zone

・A-zone : Display area (pixel area)
・B-zone : Area between A-zone and C-zone
・C-zone : Metallic bezel area



8.3 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		Unit	Note
					Bright defect	Low bright defect		
Operating inspection	1	Dot defect	Sparkle mode	1-dot	0	16	pcs	1),2),4)
				2-dots	0	0	pcs	1),2),5)
				3-dots	0	0	pcs	1),2),5)
				Density	0	3	pcs/φ10mm	1),2),6)
				Total	16		pcs	1),2)
			Black mode	1-dot	20		pcs	3),4)
				2-dots	3		Units	3), 5),10)
				3-dots	0			
				Density	3		pcs/φ10mm	3),6)
				Total	20		pcs	3)
			Density total		3		pcs/φ10mm	1),2),3),6)
		Dot defect total			30		pcs	-
	2	Line defect			See note 11)		—	11)
	3	Uneven brightness						

	No	ITEM			Max. acceptable number		Unit	Note
					Bright defect	Low bright defect		
Operating inspection	4	Stain inclusion Line shape (W : width (mm) L : length (mm))	W≦0.05	L<3.0	Ignore		pcs	7)
			W≦0.1	L≦4.0	3			
				L>4.0	0			
			W>0.1	-	0			
	5	Stain inclusion Dot shape (D : ave. dia (mm))	D≦0.25		Ignore		pcs	7)
			0.25＜D≦0.4		10			
			D>0.4		0			
Non operating inspection	6	Scratch on polarizer Line shape (W : width (mm) L : length (mm))	W≦0.05	L<3.0	Ignore		pcs	8)
			W≦0.1	L≦4.0	3			
				L>4.0	0			
			W>0.1	-	0			
	7	Scratch on polarizer Dot shape (D : ave. dia (mm))	D≦0.25		Ignore		pcs	8)
			0.25＜D≦0.4		10			
			D>0.4		0			
	8	Bubbles in polarizer (D : ave. dia (mm))	D≦0.2		Ignore		pcs	8)
			D≦0.3		10			
			D>0.3		0			
	9	Wrinkles on polarizer			Judge by limit sample		-	-

Note 1) Bright defect is judged on black raster.

2) Sparkle mode : Judge defect dot by visual inspection comparing with sample bright dot which is created following tone on black screen.

(a)bright defect

G>384

R>384

B>512

(b) low bright defect

384≧G>240

384≧R>321

512≧B>469

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-dots defect is a consecutive dot defect. Where N is 2 or greater number of defect dots. N-dots defect excludes stain, scratch, bubble, etc..

6) Density : number of defect dots inside φ10mm

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

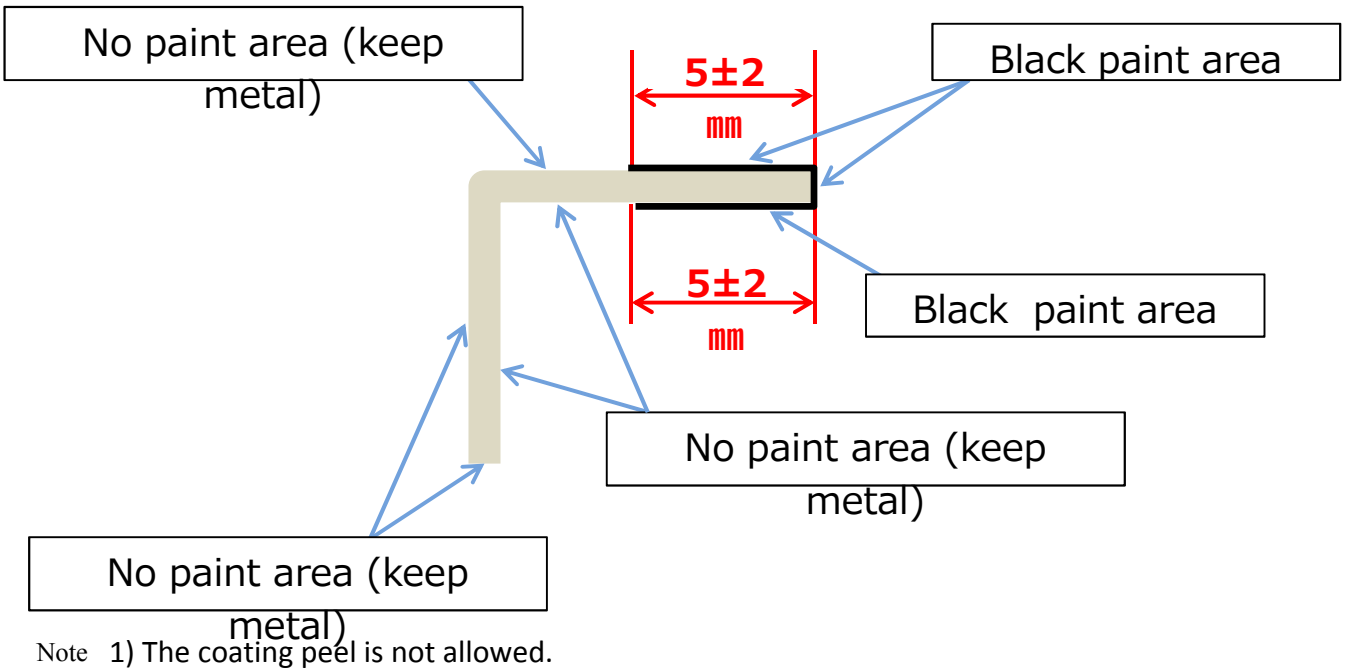
8) Polarizer area inside of B-zone is not applied.

9) No major (serious) defects when viewed in gray scale mode.

10) Regarding 2-dots defect of black mode, when the pixel of the black dot is seen as the low bright dot in the other pattern (each RGB plain color,etc.) except white raster and black raster, this low bright dot shall be counted not as 1-dot defect but as 2-dots defect.

11) If any questions arise as for the evaluation, the determination shall be made upon consultation between both parties.

12) Limit sample is set up if needed after deliberations.



Note 1) The coating peel is not allowed.
The scratch is allowed if it doesn't make coating peel.
2) The contamination which can not be wiped out is allowed.
However, the contamination which is significantly remarkable is not allowed.

9. PRECAUTION

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

9.1 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. Be careful not to drop or hit the module.

(3) The module should be installed with mounting holes of a module.

(4) Uneven force such as twisted stress should not be applied to a module when a module is mounted on the cover case. The twisted stress causes Kumi mura and the deformation of internal optical sheets and/or other parts which causes uneven brightness. 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 a space between a module and a holding board of a module so that partial force is not applied to a module.

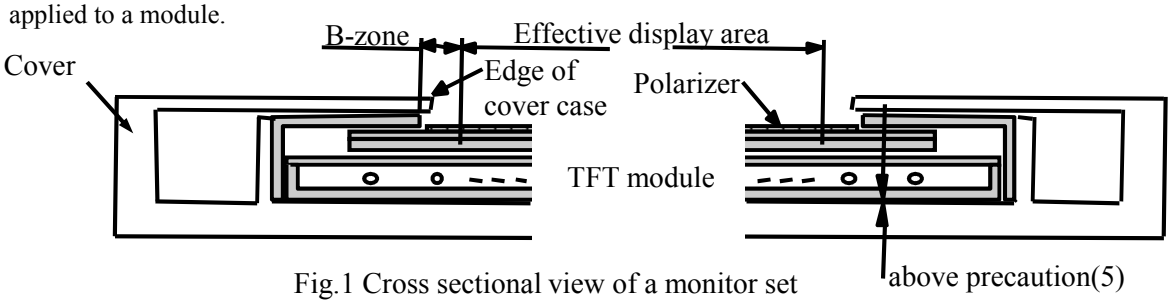


Fig.1 Cross sectional view of a monitor set

(6) The edge of a cover case should be located inside more than 1mm from the edge of a module front frame. The edge of a module front frame is not rustproofed, please process a cover case so as not to see the edge of a module front frame if necessary.

(7) 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.

(8) 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 3H pencil lead. The surface of a polarizer should not be touched and rubbed with bare hand, greasy clothes or dusty clothes.

(9) 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 on a TFT cell.

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

(11) The module should not be opened or modified. It may cause not to operate properly.

(12) Metallic bezel of a module should not be handled with bare hand or dirty gloves. Otherwise, color of a metallic 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.

(13) LED cables should not be pulled and held.

(14) Module and monitor set should be transported under standing conditions (landscape/lateral, not portrait/vertical), should not be transported under flat/horizontal condition.

9. Otherwise, the vibration of LCD cell generates air flow which can suck dust particles in module.

(15) Please note not leaving the portrait position for a long time to avoid Mura.

(16) The structure of module is not airtight. The air blow to the panel surface may cause the ingress of dust particles into module which resulted in display defects and/or malfunctions. Please do suction or wiping for removal of dust particles on the panel surface.

(17)This product is designed on the premise of using it upright. In case of using this product at other angles, please evaluate under actual set-in condition.

(4) 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 fading of displayed quality.

9.2 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.

(3) Optical response time, luminance and chromaticity depend on the temperature of a TFT module.

(4) 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 fading of displayed quality.

(5) Fixed patterns displayed on a module for a long time may cause after-image. It will be recovered soon.

(6) 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.

(7) Noise may be heard when a backlight is operated. If necessary, sufficient suppression should be done by system manufacturers.

(8) The module should not be connected or removed while a main system works.

(9) Inserting or pulling I/F connectors causes any trouble when power supply and signal data are on-state. I/F connectors should be inserted and pulled after power supply and signal data are turned off.

9.3 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, persons who are 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.

9.4 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.

9.5 Precaution to storage

When modules for replacement 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. It is recommended to be stored at 0 to 35℃ with normal humidity (60%RH or less).

(2) The surface of polarizers should not come in contact with any other object. It is recommended that modules should be stored in the shipping box of Panasonic Liquid Crystal Display Co., Ltd.

9.6 Precaution to fluid

(1) Since a module consists of a TFT cell and electronic circuits, which are very weak to fluid, keep fluid from entering between the frame and the polarizing plate.

9.7 Safety

(1) Since a TFT cell is made of glass, handling to the broken module should be taken care sufficiently in order not to be injured. Hands touched liquid crystal from a broken cell should be washed sufficiently.

(2) The module should not be taken apart during operation so that backlight drives by voltage.

9.8 Environmental protection

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

9.9 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.

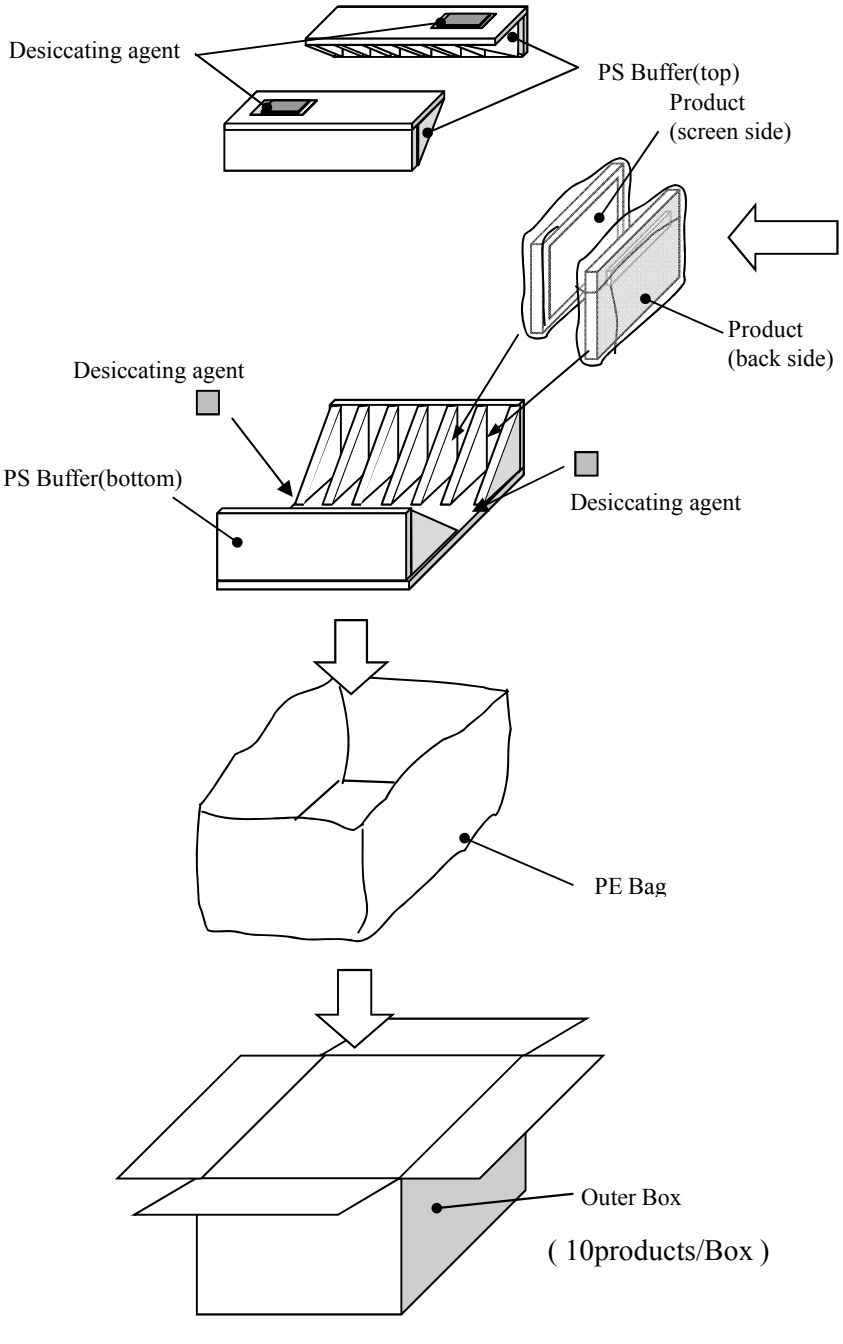
(2) In no event shall Panasonic Liquid Crystal Display Co., Ltd. be liable for any incidental, indirect or consequential damages in connection with the installation or use of this product, even if informed of the possibility thereof in advance. These limitations apply to all causes of action in the aggregate,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

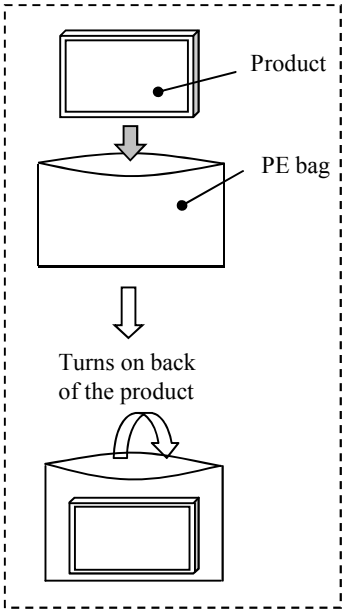
9.10 Others

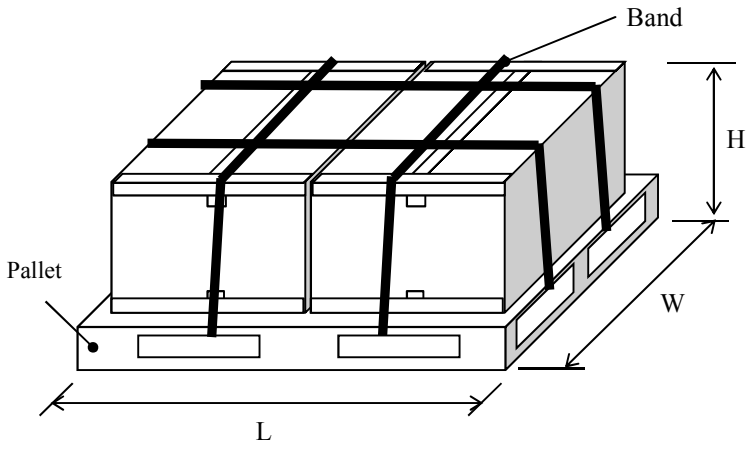
When we change an electrical component, if it affects the content in the specification (characteristics, reliability, etc), we will inform your company and get approval in advance.

In other cases, we may change the electrical component without notice because of their availability.

10. PACKING







Size : 1200(L) × 1000(W) × 640(H)mm
Weight : (112)kg
(20 products/pallet)

11. Reliability test

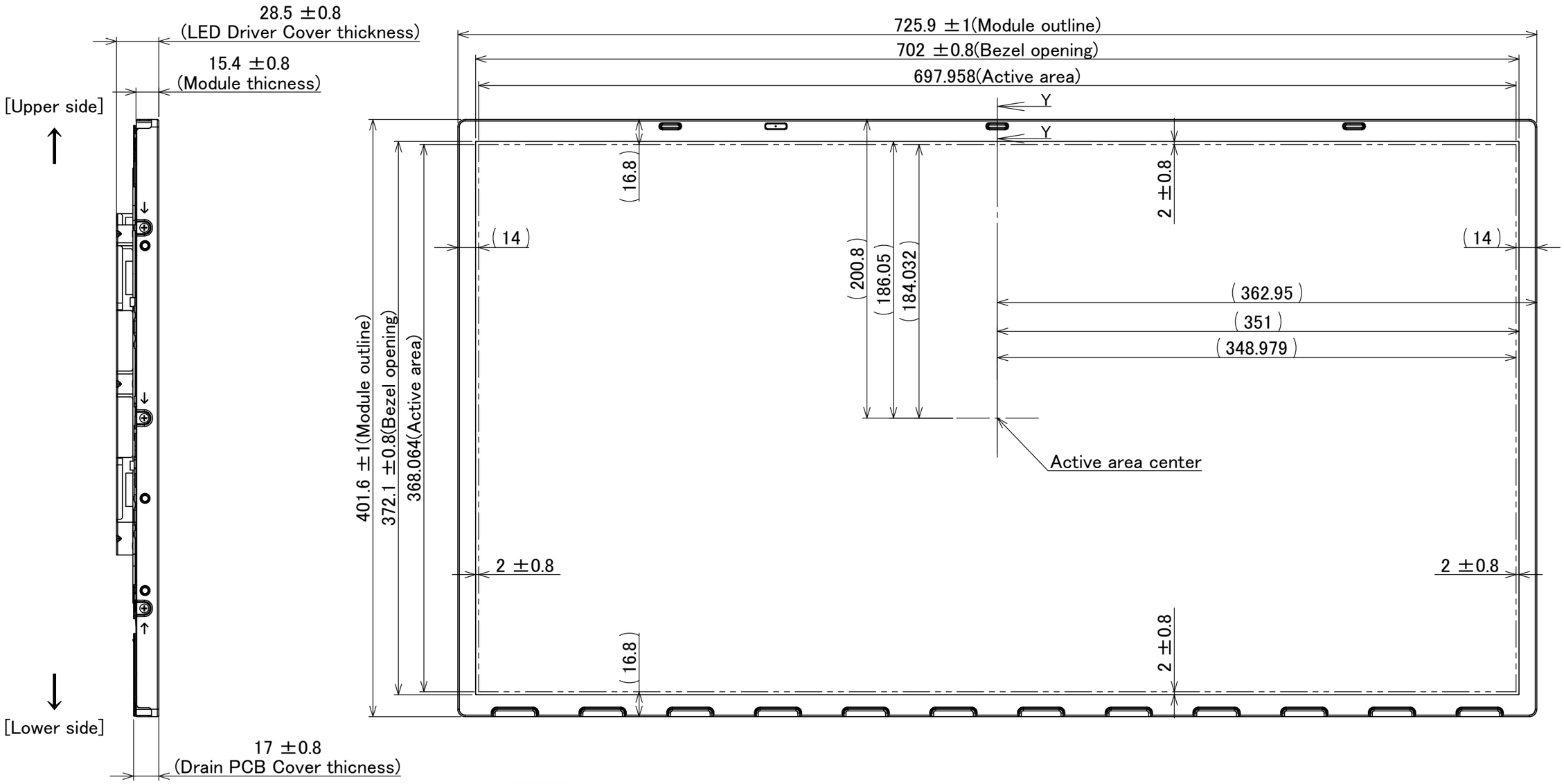
No.	Item		condition	Quantity	Period	
					determination	end
1	Low Temperature / Operating		Ta=0℃	3	500h	1000h
2	High Temperature / Operating		Ta=45℃	3	500h	1000h
3	High Temperature High Humidity / Operating		65℃ 85%RH	3	500h	1000h
4	Low Temperature / Storage		Ta=-20℃	3	500h	1000h
5	High Temperature / Storage		Ta=70℃	3	500h	1000h
6	High Temperature High Humidity / Storage		40℃ 85%RH	3	500h	1000h
7	Heat shock		-25/70℃ 30min./30min.	3	100cy.	200cy.
8	Heat shock test for solder		-35/85℃ 30min./30min.	3	200cy.	500cy.
	ESD	The surface of a metallic bezel and a LCD panel	C = 150 pF, R = 330 ohm Environment :15-35℃/30-60%RH V input : +/- 8kV Aerial discharge control signals.	3	No Latch-up	-
		I/F connector pins	C = 200 pF, R = 0 ohm Environment: 15-35℃/30-60%RH V input : +/- 100V Contact discharge control signals.	3	No Latch-up	-

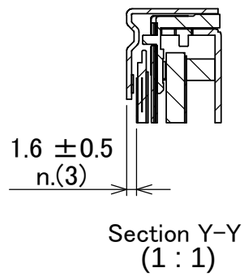
Result Evaluation

Display function should be kept.

12. Dimensional Outline

(1)Front view

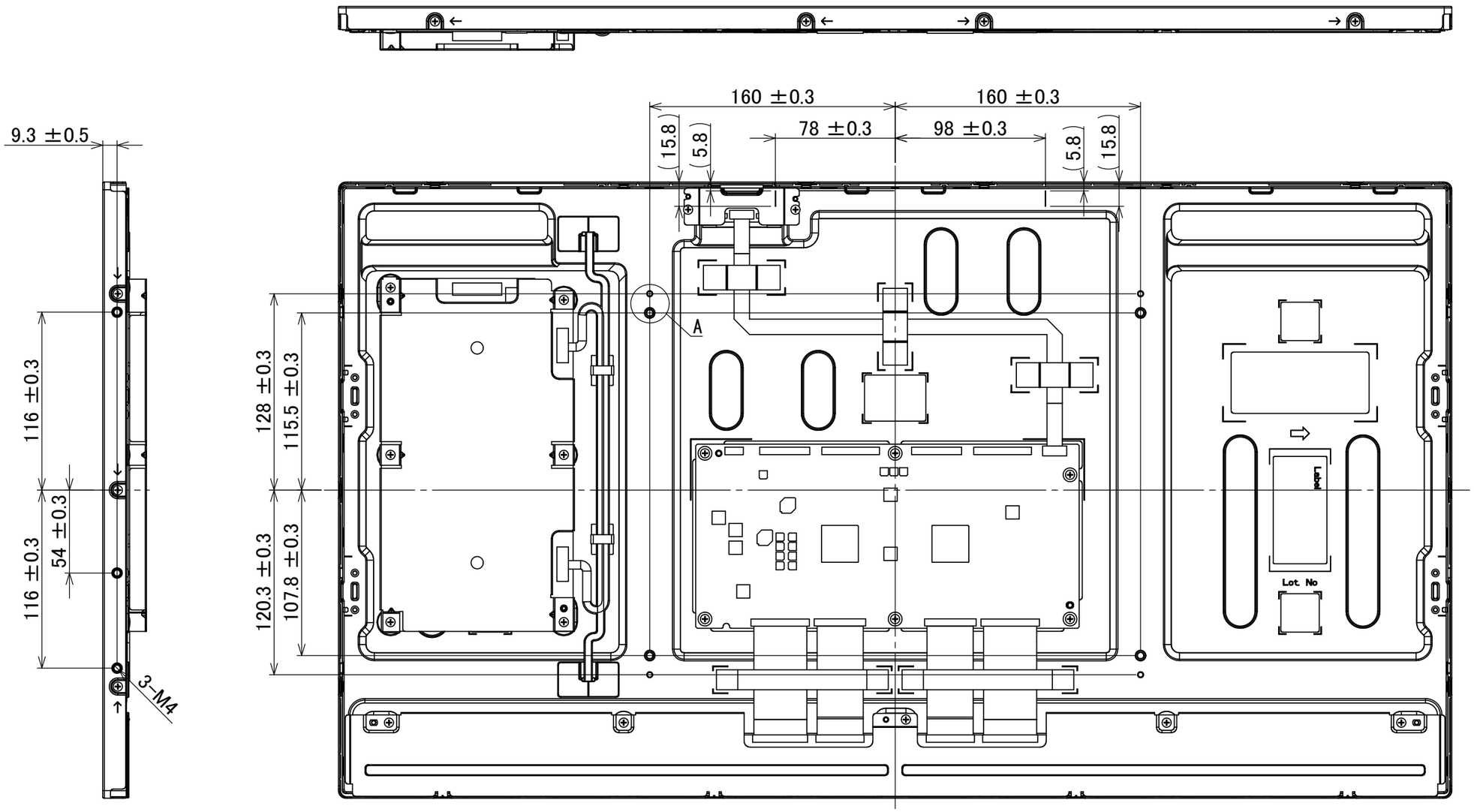


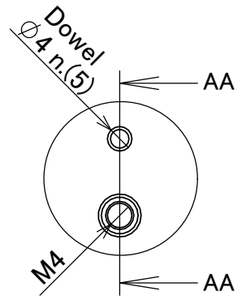


Section Y-Y
(1 : 1)

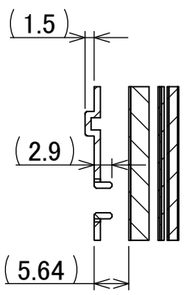
Note1) The dimension in a parenthesis is a reference value.
2) The general tolerance : JIS B 0405-m
3) The measuring method depends on Panasonic Liquid Crystal Display CO., Ltd standard.
4) The customer mount M4 : Torque MAX. 1.0N・m(10.2kgf・cm)
5) The straight part should be 0.8mm or more.
6) Warp quantity ≦ 1mm.

(2)Back view
Detail of customer mount

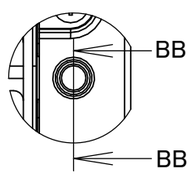




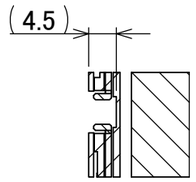
Detail A
(1 : 1)
4 places



Section AA-AA

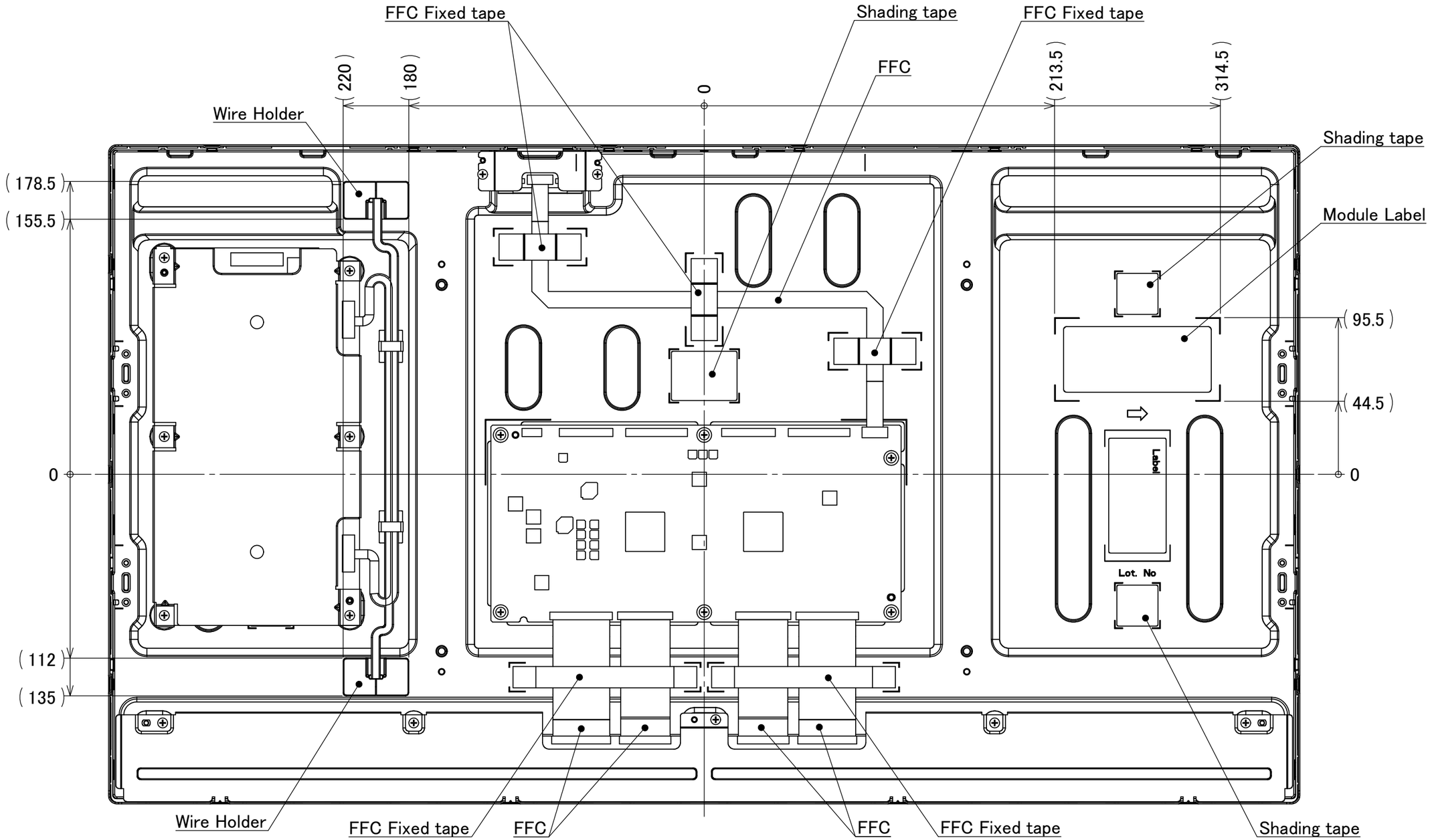


Detail B
(1 : 1)
6 places

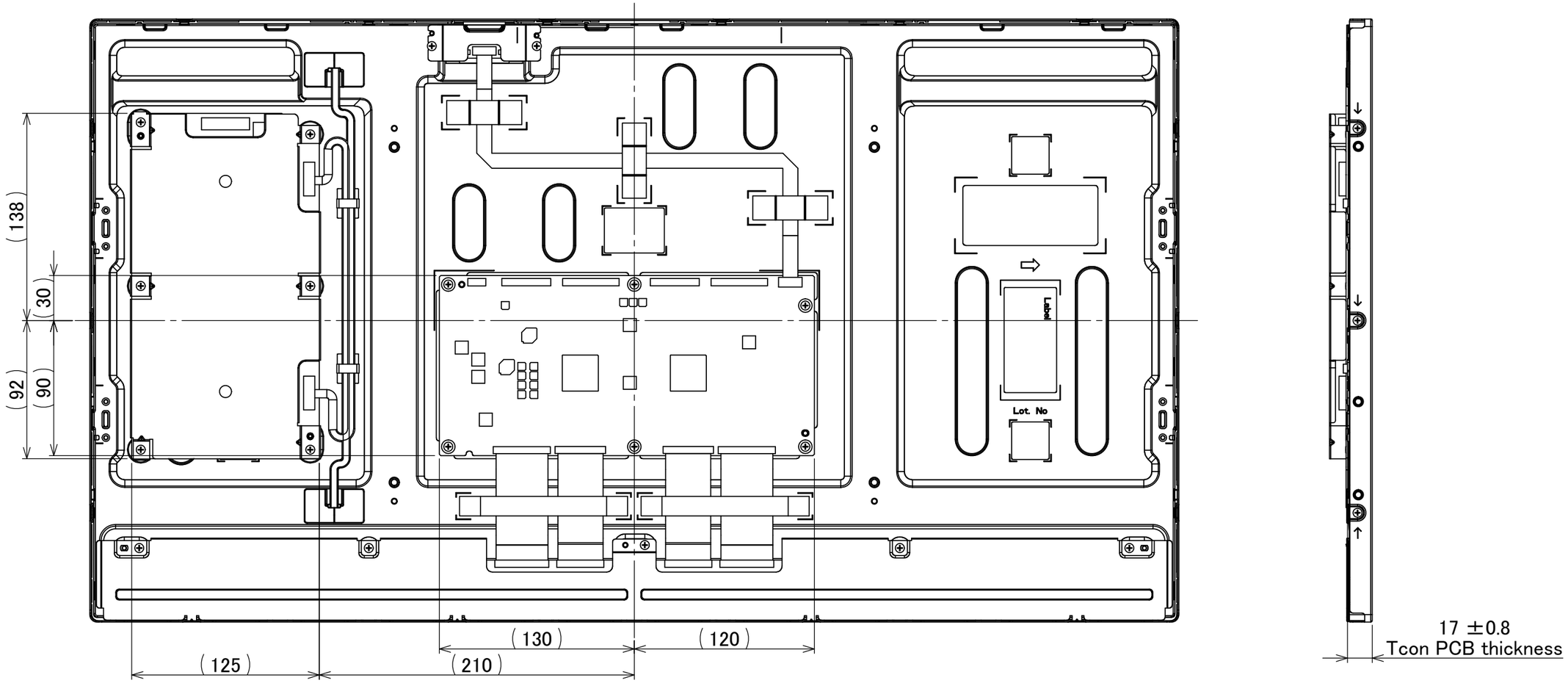


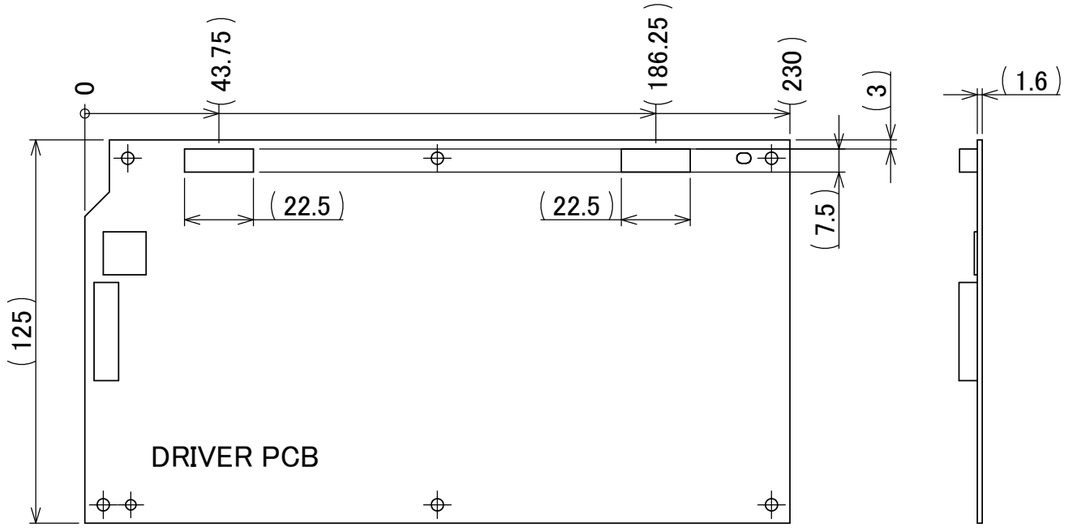
Section BB-BB

(2)Back view
Label and Tape area and Holder position



(2)Back view
LED DRIVER PCB and TCON PCB dimension





Panasonic Liquid Crystal Display Co., Ltd.	Date	Sep.27,2018	Sheet No.	IPS4PS 2615 VVX31P163H01	Page	15 – 4/4