Panasonic Liquid Crystal Display Co.,Ltd.

For Messrs. Shenzhen Beacon Display Technology Co., Ltd.

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

VVX55P147H00

CONTENTS

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

Accepted by Date:	Panasonic Liquid Crystal Display Co., Ltd.
	Approved by
	Reviewed by 森下俊輔
	Proposed by 菊池秀徳

RECORD OF REVISION

Date	The upper section : Previous revision The lower section : New revision Sheet No.	Page	Summary
Nov.08,2016	IPS4PS 2610 VVX55P147H00-1	10-1/1	Added Rev.B
	IPS4PS 2610 VVX55P147H00-2	10-1/1	
	IPS4PS 2615 VVX55P147H00-1	15-1/2	Corrections ・SECTION X1-X1 , SECTION X2-X2
	IPS4PS 2615 VVX55P147H00-2	15-1/2	
Jun.07,2017	IPS4PS 2610 VVX55P147H00-2	10-1/1	Added Rev.C
	IPS4PS 2610 VVX55P147H00-3	10-1/1	
Apr.24,2018	IPS4PS 2610 VVX55P147H00-3	5-1/2	Added spec for brightness uniformity Buni_Min.:75%
	IPS4PS 2610 VVX55P147H00-4	5-1/2	
Mar.19,2019	IPS4PS 2610 VVX55P147H00-4	10-1/1	Added Rev.D
	IPS4PS 2610 VVX55P147H00-5	10-1/1	

DESCRIPTION

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

Product Name : VVX55P147H00

Product Factory : Panasonic Liquid Crystal Display Co., Ltd. (Japan)

General specifications

Effective display area	: (H) 1209.6 × (V) 680.4	(mm)
Number of pixels	: (H) 3,840 × (V) 2,160	(pixels)
Pixel pitch	: (H) 0.315 × (V) 0.315	(mm)
Color pixel arrangement	: R+G+B 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° atφ=0°,90°,180°,270°, CR≧10)	
Input signal	: 8-channel LVDS (LVDS : Low voltage differential signaling)	
Back light	: Egde LED Type	
External dimensions	: Typ. (H) 1253.6 × (V) 724.4 × (T) 33.3 (mm)	
Weight	: Typ. 19.0 (kg)	

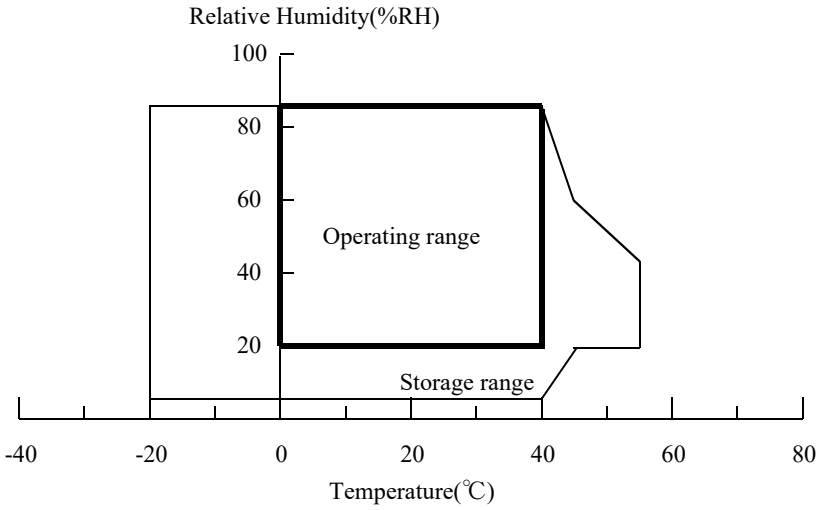
1. ABSOLUTE MAXIMUM RATINGS

1. 1 Environmental absolute maximum ratings

ITEM	Operating		Storage		UNIT	NOTE
	Min.	Max.	Min.	Max.		
Temperature	0	40	-20	55	℃	1),5)
Humidity	2)		2)		%RH	1)
Vibration	-	4.9(0.5 G)	-	9.8(1.0G)	m/s^2	3)
Shock	-	29.4(3 G)	-	294(30G)	m/s^2	4)
Corrosive gas	Not acceptable		Not acceptable		-	

Note 1) Temperature and Humidity should be applied to the glass surface of a 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 ℃.



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

4) Pulse width of the shock is 10 ms.

5) The temperature of LCD front surface would be 60 ℃/ 20%RH in operating, it may affect the optical characteristics however it does not damage the function of the module.

1. 2 Electrical absolute maximum ratings

(1)TFT-LCD module GND = 0 V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Power supply voltage	V_{LCD}	0	13.2	V	
Input voltage for logic	-	-0.3	4.0	V	1)

Note 1) It is applied to LVDS-Rx and LVDSSEL

(2) Back-light Driver GND = 0 V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Input voltage	V_{BL}	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.

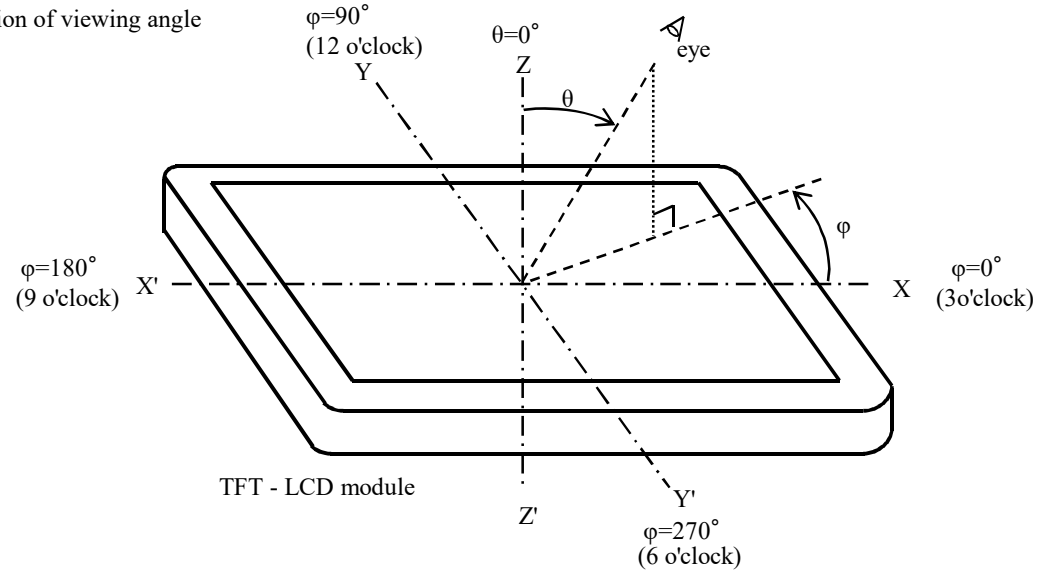
Measuring equipment : CS-2000, or equivalent

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

VBL=24V ,PWM on duty = 100 %

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast ratio		CR		1000	1450	-	-	2)
Response time	Rise	ton		-	10	20	ms	3)
	Fall	toff		-	8	20	ms	3)
Brightness of white		Bwh		560	700	-	cd/m^2	
Brightness uniformity		Buni		75	85	-	%	4)【Gray scale =1023】
Color chromaticity (CIE)	Red	x	θ= 0 ° 1)	0.620	0.650	0.680	-	【Gray scale =1023】
		y		0.303	0.333	0.363		
	Green	x		0.272	0.302	0.332		
		y		0.578	0.608	0.638		
	Blue	x		0.118	0.148	0.178		
		y		0.025	0.055	0.085		
	White	x		0.254	0.284	0.314		
		y		0.276	0.306	0.336		
Variation of color position (CIE)	Red	Δx	θ= 50 ° φ= 0 °, 90 °, 180 °, 270 ° 1)	-	-	0.04	-	5) 【Gray scale =1023】
		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)

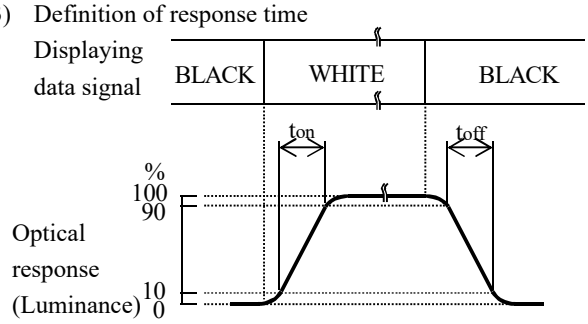
Note 1) Definition of viewing angle



Note 2) Definition of contrast ratio (CR)

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

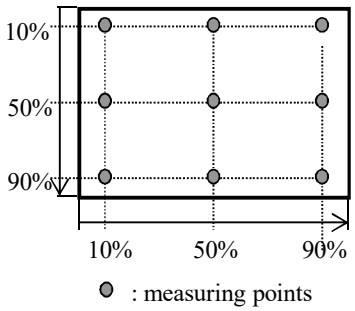
3) Definition of response time



4) Definition of brightness uniformity

The brightness uniformity is defined as the following equation.

$$B_{uni} = \frac{\text{Min brightness of 9 points}}{\text{Brightness of center}} \times 100$$



5) Variation of

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 °

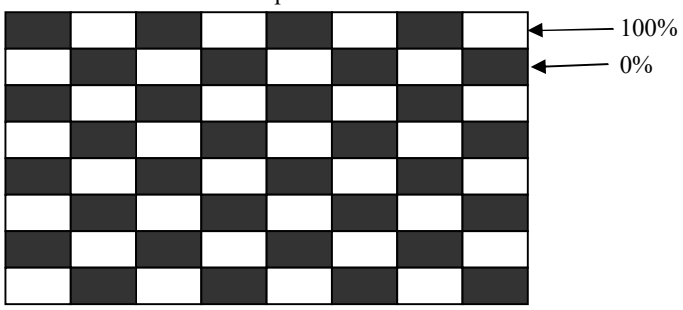
Evaluetion conditions are on horizontal & vertical axis

7) Image sticking

Condition (a) Operating mosaic pattern for 60 seconds and gray scale (22%) for 10 seconds.

(b) Operating mosaic pattern for 60 minutes and gray scale (22%) for 30 minutes.

Mosaic pattern



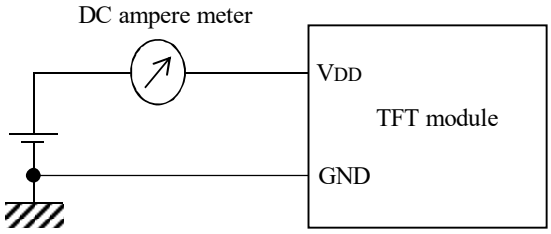
3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

Ta = 25 ℃ , GND = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage		VLCD	11.4	12.0	12.6	V	
Power supply current		ILCD	-	3.0	3.9	A	1)
Ripple voltage of power supply		VLCDR	-	-	500	mV	
LVDS select	High	LVDSSEL	1.7	-	3.6	V	
	Low		0	-	0.5	V	

Note 1) fV=60.0Hz, DCLK=70.8MHz, 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		VBL	21.6	24.0	26.4	V	
Input current		IBL	-	7.4	8.2	A	PWM on-duty=100% VBL=24V,120Hz
ON/OFF Control voltage	ON	ON/OFF	2.0	3.3	5.0	V	
	OFF		-0.3	-	0.8		
PWM signal	Low	Vpwm	-0.3	-	0.8	V	
	High		2.0	-	3.3		
PWM frequency		-	90	120	360	Hz	2)
On-duty range for burst-dimming		On-duty	10	-	100	%	
LED Life time		-	50,000	-	-	hours	3)

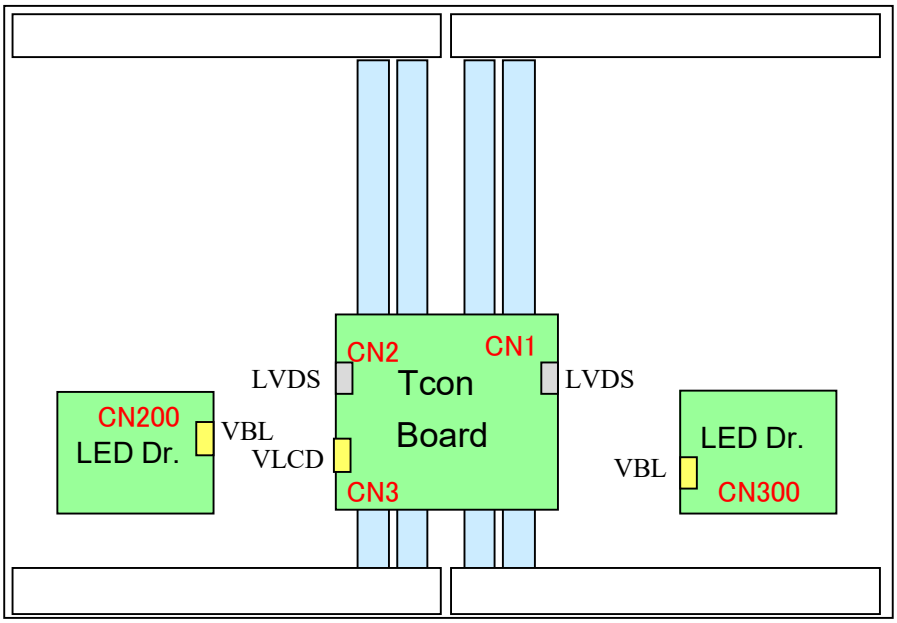
Note 1) This characteristics should be applied putting on the LED about 60 minutes later with ambient temperature. (Ta = 25 ℃ ± 2 ℃)

2) It is recommended to choose PWM frequency as not occurred beat noise.

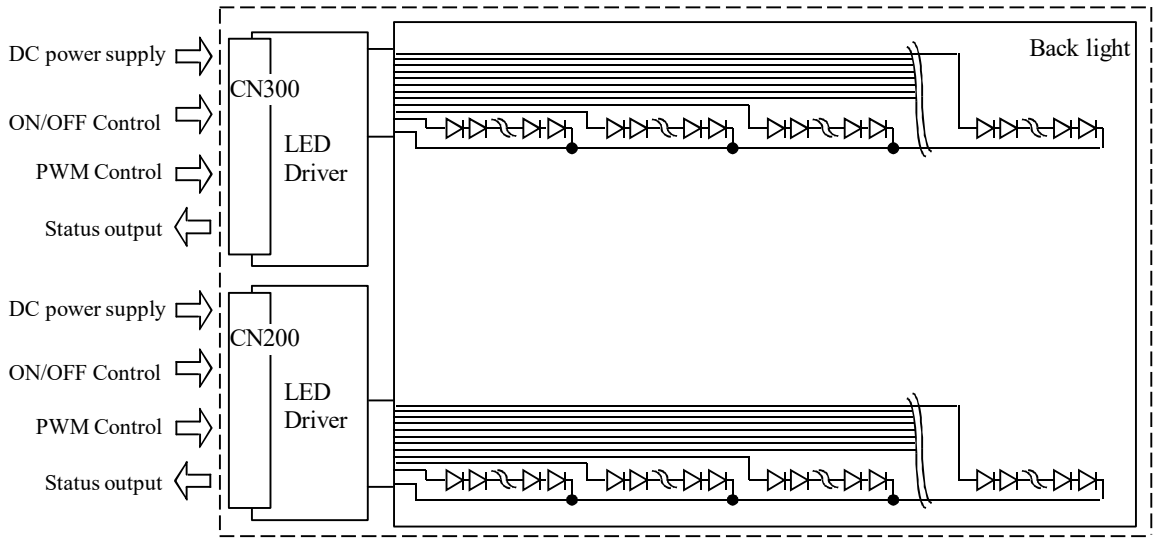
3) The life time is estimated value and not guaranteed value.
Lifetime of a LED is defined. The life is determined as the time at which brightness of the LED is 50 % compared to that of initial value at that typical LED current on condition of continuous operating at 25 ± 2 ℃.

4. BLOCK DIAGRAM

4.1 TFT LCD module



4. 2 Back light unit



5. INTERFACE PIN ASSIGNMENT

5. 1 TFT-LCD module

CN1:JAE FI-RNE51SZ-HF

(Matching connector : JAE FI-R51-HL)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	GND	Ground	-	1)
2	RxA0-	LL area odd-pixel data	I	2)
3	RxA0+			
4	RxA1-			
5	RxA1+			
6	RxA2-			
7	RxA2+			
8	CLKA-	LL area odd-pixel clock	I	3)
9	CLKA+			
10	RxA3-	LL area odd-pixel data	I	2)
11	RxA3+			
12	RxA4-			
13	RxA4+			
14	RxB0-	LL area even-pixel data	I	2)
15	RxB0+			
16	RxB1-			
17	RxB1+			
18	RxB2-			
19	RxB2+			
20	CLKB-	LL area even-pixel clock	I	3)
21	CLKB+			
22	RxB3-	LL area even-pixel data	I	2)
23	RxB3+			
24	RxB4-			
25	RxB4+			

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
26	GND	Ground	-	1)
27	RxC0-	LR area odd-pixel data	I	2)
28	RxC0+			
29	RxC1-			
30	RxC1+			
31	RxC2-			
32	RxC2+			
33	CLKC-	LR area odd-pixel clock	I	3)
34	CLKC+			
35	RxC3-	LR area odd-pixel data	I	2)
36	RxC3+			
37	RxC4-			
38	RxC4+			
39	RxD0-	LR area even-pixel data	I	2)
40	RxD0+			
41	RxD1-			
42	RxD1+			
43	RxD2-			
44	RxD2+			
45	CLKD-	LR area even-pixel clock	I	3)
46	CLKD+			
47	RxD3-	LR area even-pixel data	I	2)
48	RxD3+			
49	RxD4-			
50	RxD4+			
51	GND	Ground	-	1)

Note 1) All GND pins shall be grounded. Metal bezel is internally connected to GND.

2) Rx mn+ and Rx mn- (m=A,B,C,D n=0,1,2,3,4) should be wired by twist-pairs, respectively.

3) CLKm+ and CLKm- (m=A,B,C,D) should be wired by twist-pairs, respectively.

CN2:JAE FI-RNE51SZ-HF
(Matching connector : JAE FI-R51-HL)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	GND	Ground	-	1)
2	RxE0-	RL area odd-pixel data	I	2)
3	RxE0+			
4	RxE1-			
5	RxE1+			
6	RxE2-			
7	RxE2+			
8	CLKE-	RL area odd-pixel clock	I	3)
9	CLKE+			
10	RxE3-	RL area odd-pixel data	I	2)
11	RxE3+			
12	RxE4-			
13	RxE4+			
14	RxF0-	RL area even-pixel data	I	2)
15	RxF0+			
16	RxF1-			
17	RxF1+			
18	RxF2-			
19	RxF2+			
20	CLKF-	RL area even-pixel clock	I	3)
21	CLKF+			
22	RxF3-	RL area even-pixel data	I	2)
23	RxF3+			
24	RxF4-			
25	RxF4+			

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
26	GND	Ground	-	1)
27	RxG0-	RR area odd-pixel data	I	2)
28	RxG0+			
29	RxG1-			
30	RxG1+			
31	RxG2-			
32	RxG2+			
33	GLKG-	RR area odd-pixel clock	I	3)
34	GLKG+			
35	RxG3-	RR area odd-pixel data	I	2)
36	RxG3+			
37	RxG4-			
38	RxG4+			
39	RxH0-	RR area even-pixel data	I	2)
40	RxH0+			
41	RxH1-			
42	RxH1+			
43	RxH2-			
44	RxH2+			
45	CLKH-	RR area even-pixel clock	I	3)
46	CLKH+			
47	RxH3-	RR area even-pixel data	I	2)
48	RxH3+			
49	RxH4-			
50	RxH4+			
51	GND	Ground	-	1)

Note 1) All GND pins shall be grounded. Metal bezel is internally connected to GND.
2) Rx mn+ and Rx mn- (m=E,F,G,H n=0,1,2,3,4) should be wired by twist-pairs, respectively.
3) CLKm+ and CLKm- (m=E,F,G,H) should be wired by twist-pairs, respectively.

CN3:JST S13B-PH-SM4-TB(LF)(SN)
(Matching connector : JST PHR-13

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	GND	Ground	-	1)
2	GND			
3	GND			
4	GND			
5	GND			
6	GND			
7	VLCD	Power (+12Vtyp.)	-	2)
8	VLCD			
9	VLCD			
10	VLCD			
11	VLCD			
12	VLCD			
13	LVDSSEL	LVDS Format select	I	3)

1) All GND pins shall be grounded. Metal bezel is internally connected to GND.
2) All VLCD pins shall be connected to +12.0V(Typ.).
3) Low or Open : VESA mode , High : JEIDA mode
LVDSSEL pin is Pull-Down (10k-ohm).

5. 2 Back light unit

CN200/CN300 : JST S14B-PHA-SM-TB(LF)(SN)
(Matching connector : JST PHR-14)

PIN No.	SYMBOL	DESCRIPTION	I/O	NOTE
1	VBL	Power supply (Typ. +24.0V)	-	1)
2	VBL			
3	VBL			
4	VBL			
5	VBL			
6	GND	GND (0V)	-	2)
7	GND			
8	GND			
9	GND			
10	GND			
11	FAIL	Status output (Normal:GND Abnormal:Open)	O	
12	ON/OFF	High : LED ON(3.3V) Low : LED OFF	I	
13	IC	Internally Connected, Keep Open	-	
14	PWM	External PWM dimming	I	

Note 1) All VBL pins shall be connected to +24.0V(Typ.).
2) All GND pins shall be grounded. Metal bezel is internally connected to GND.

5.3 Data Divid

Display Data (3840x2160) should be divided into four parts: each one is 960 x 2160 resolution.

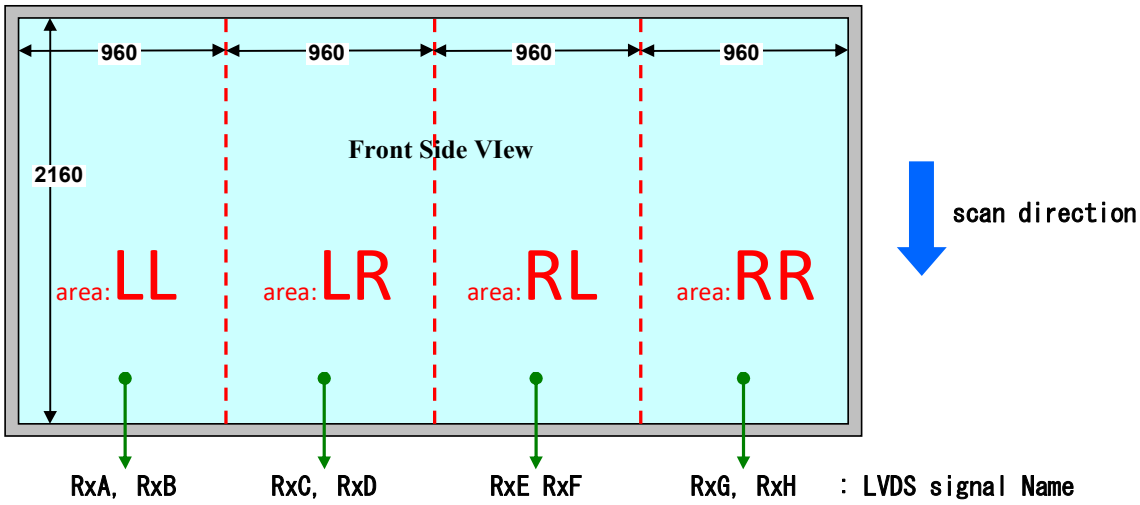
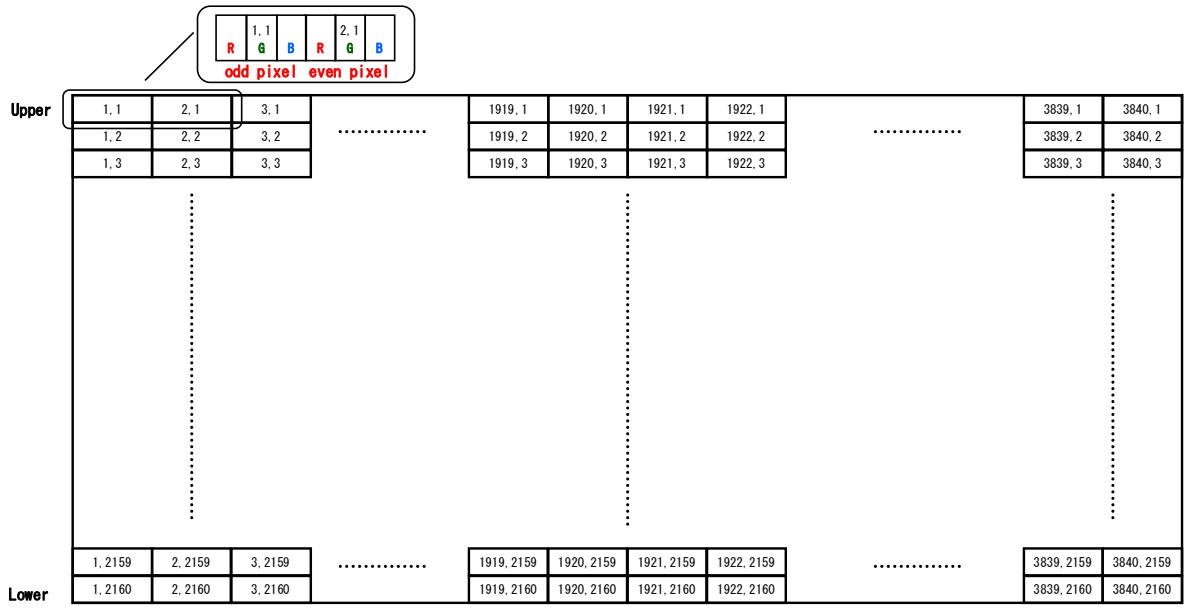


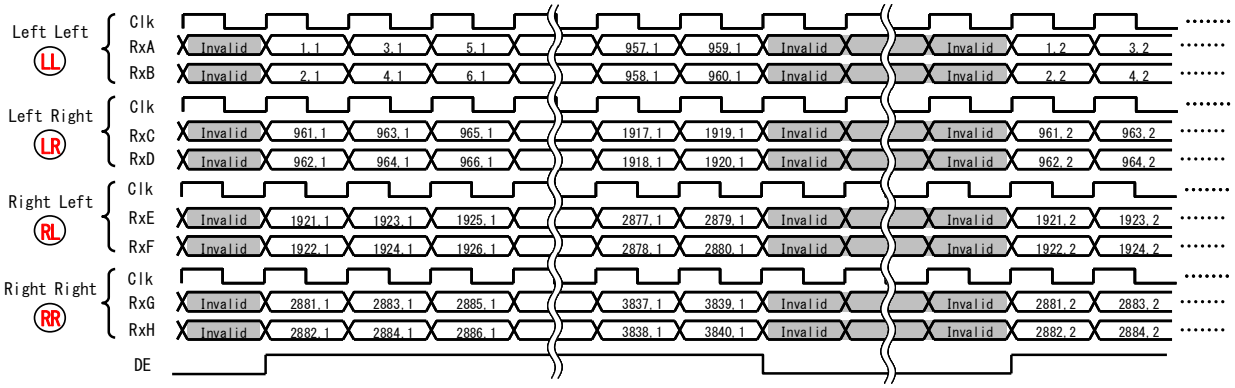
Fig.2 Data Divid

LL : Left-Left
LR : Left-Right
RL : Right-Left
RR : Right-Right

5.4 Correspondence between input data and display image

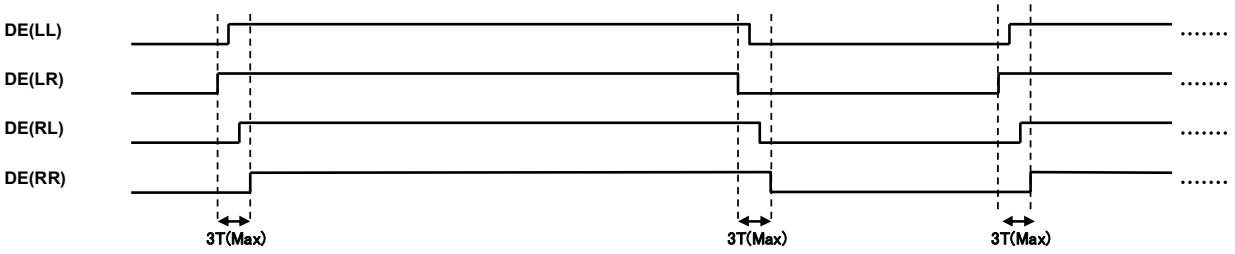
Display data of adjacent 8 pixels are latched during one cycle of DCLK.





Permission Delay of Sync Timing (Data Enable)

(at LVDS_Txinput)



T = Pixel Clock

5.5 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
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	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
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	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

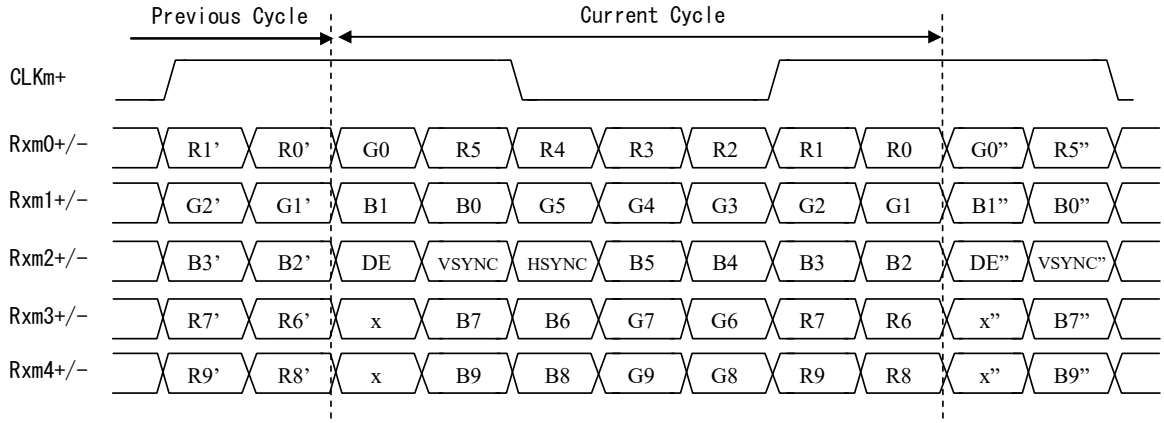
Note 1) Definition of gray scale :
Color(n)・・・・Number in parenthesis indicates gray scale level.
Larger n correspondsto brighter level.

2) Data : 1 : High, 0 : Low

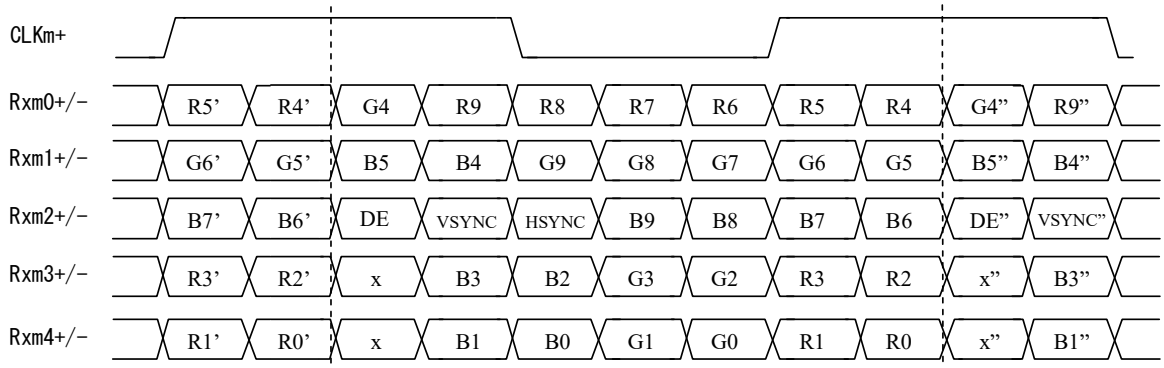
6. INTERFACE TIMING

6. 1 LVDS receiver timing

6.1.1 AC Characteristics

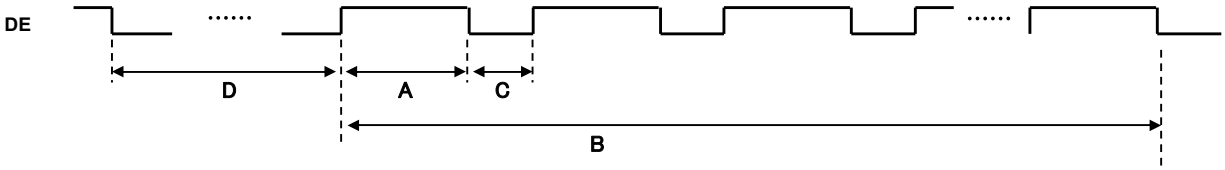


VESA : LVDSSEL = Low or Open



JEIDA : LVDSSEL = High

6.1.2 Input Signal Timing

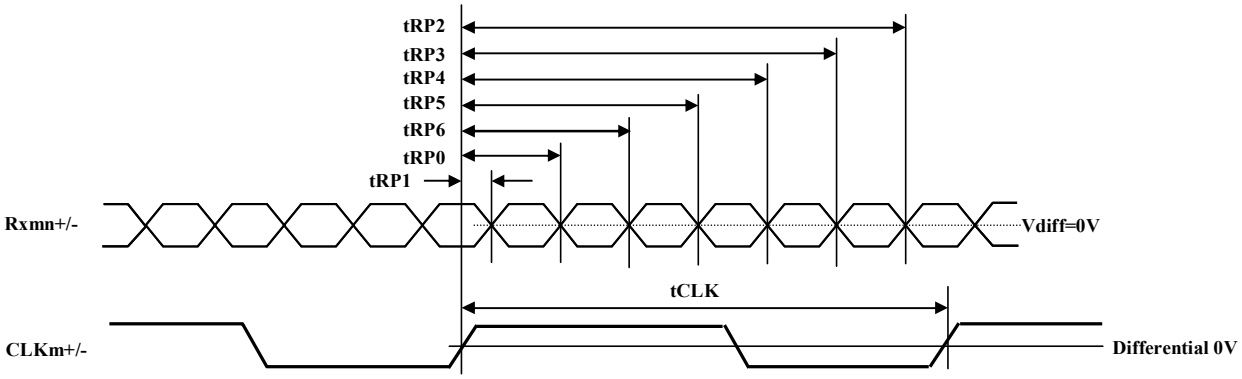


	Unit	Min.	Typ.	Max.	Note
Horizontal Active (A)	clk		480		
Vertical Active (B)	H		2160		
Horizontal Blanking (C)	clk	12	64	100	
Vertical Blanking (D)	H	5	10	600	
Pixel Clock	MHz	60	70.8	78	
Horizontal Frequency (A+C)	kHz	100	130.2	140	
Vertical Frequency (B+D)	Hz	46	60	62	

Please use it so that all ITEM matches specifications.

6. 2 LVDS receiver timing

6.2.1 AC Characteristics



m : A - H

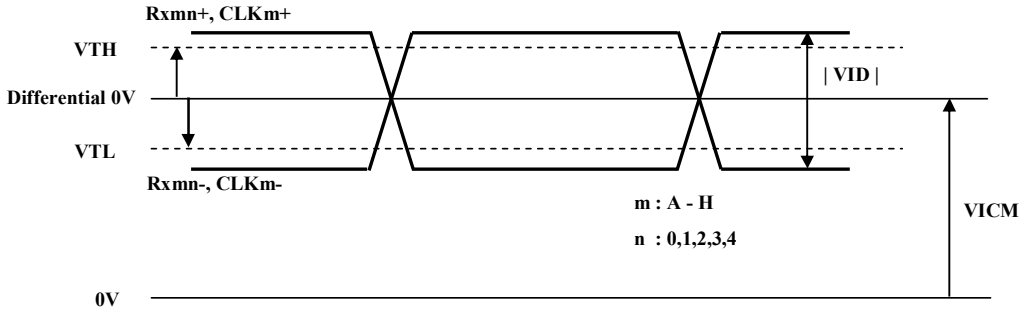
n : 0,1,2,3,4

Symbol	Parameter	Min.	Typ.	Max.
tCLK	CLK Period	12.82	14.12	16.67
tRP1	Input data Position0	-0.45	0.0	0.45
tRP0	Input data Position1	tCLK*1/7 - 0.45	tCLK*1/7	tCLK*1/7 + 0.45
tRP6	Input data Position2	tCLK*2/7 - 0.45	tCLK*2/7	tCLK*2/7 + 0.45
tRP5	Input data Position3	tCLK*3/7 - 0.45	tCLK*3/7	tCLK*3/7 + 0.45
tRP4	Input data Position4	tCLK*4/7 - 0.45	tCLK*4/7	tCLK*4/7 + 0.45
tRP3	Input data Position5	tCLK*5/7 - 0.45	tCLK*5/7	tCLK*5/7 + 0.45
tRP2	Input data Position6	tCLK*6/7 - 0.45	tCLK*6/7	tCLK*6/7 + 0.45

6.2.2 SSC

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

6.2.3 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

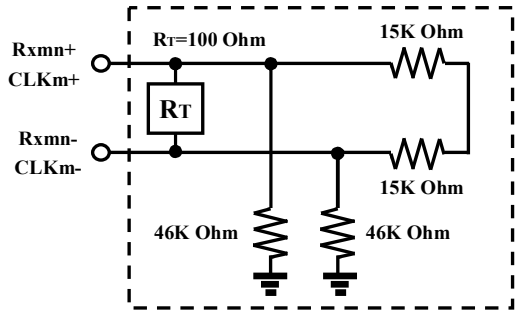
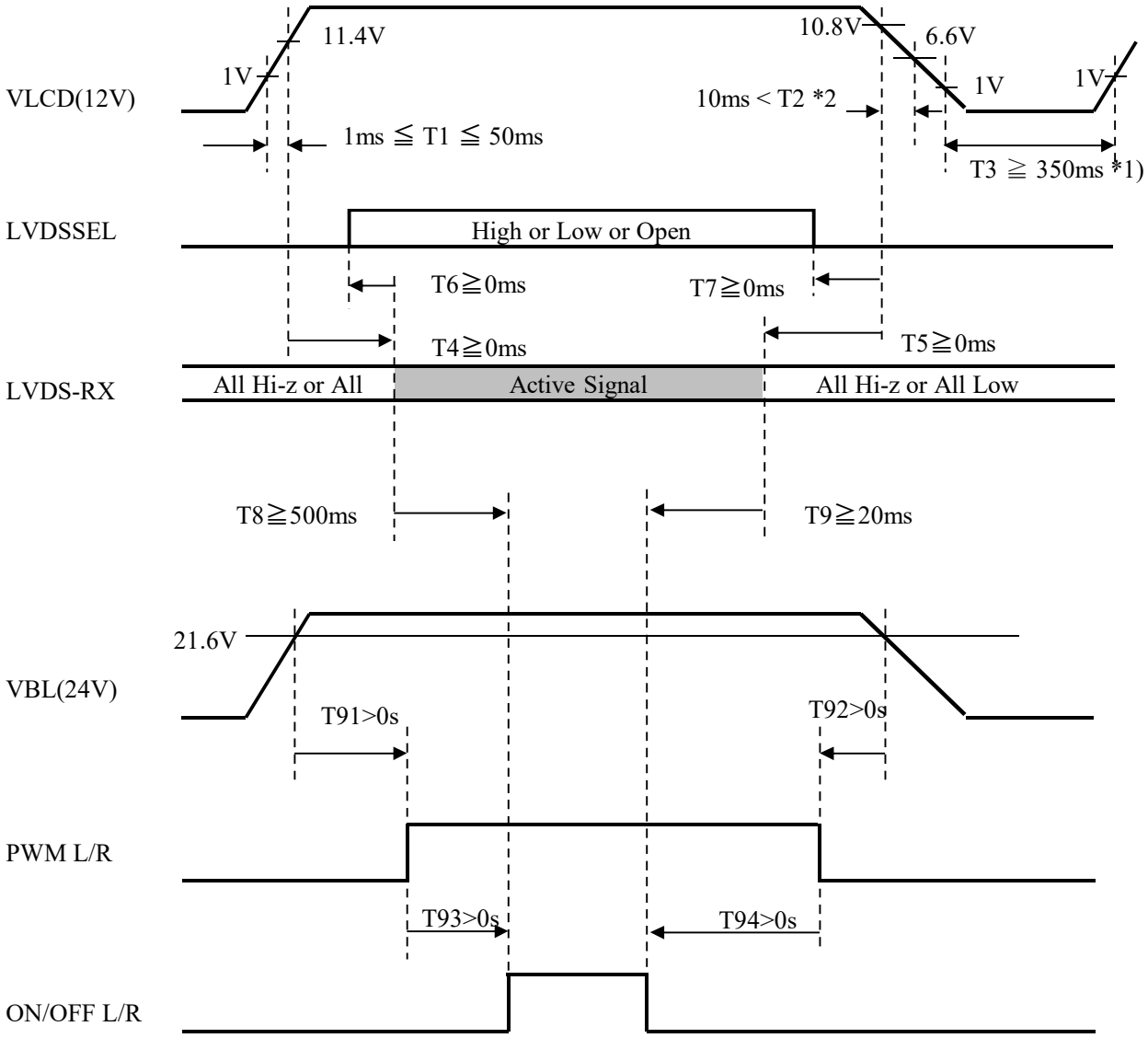


Figure RPD

6.3 Timing between interface signals power supply



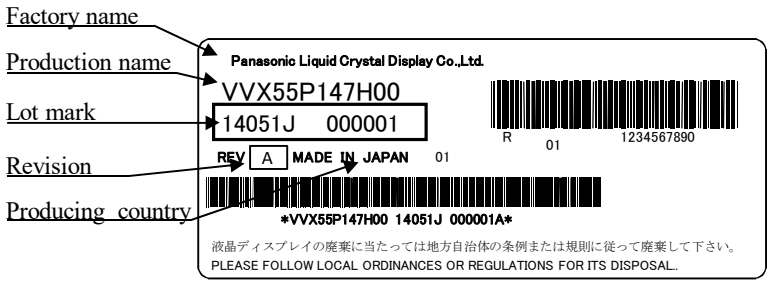
*1) There is a case that afterimage can be seen if this specification is not followed. However, as long as the afterimage can be allowed, it is tolerated.

*2) The T2 is recommended value, the case when filed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

7. LABEL FORMAT

7.1 Label

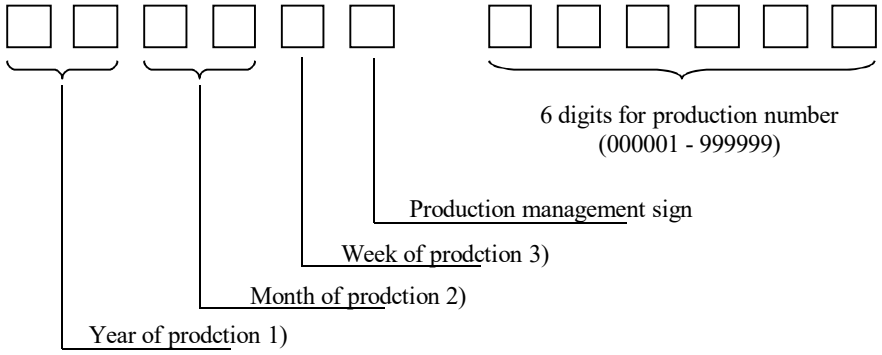
The label is on the metallic bezel as shown in 12. External Dimensional.
The style of character will be changed without notice.



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
14	2014
15	2015
16	2016

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

Revision	LGP maker	Reflection sheet maker
A	LGP_A	Ref_A
B	LGP_B	Ref_A
C	LGP_B	Ref_B
D	LGP_C	Ref_B

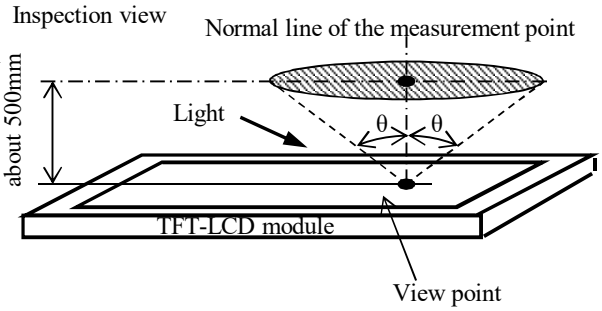
8. COSMETIC SPECIFICATIONS

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 operating and non-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

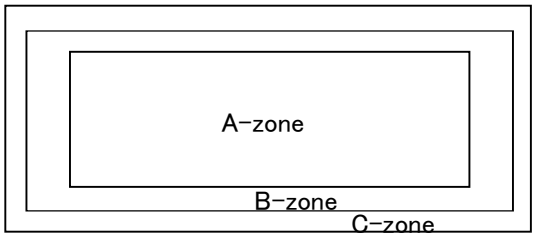
a) Temperature : 25 degrees

b) Ambient light : about 700 lx and non-directive when operating inspection.
: about 100 lx and non-directive when operating inspection (black raster).
: 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: Bright defect	Max. acceptable number: Low bright defect	Unit	Note
Operating inspection	1	Dot defect (TFT/LCD Dot defect)	Sparkle mode	1-dot	0	16	pcs	1),2),4)
				2-dots	0	0	pcs	1),2),4)
				3-dots	0	0	Units	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	2),3),6)
		Brightness Dot defect [D : ave. dia (mm)]	D≦0.40		0	10	pcs	1),2)
			D>0.40		0	0	pcs	
		Dot defect total			30		pcs	-
	2	Uneven brightness	Kumi mura		The brightness of Kumi mura is under 300% of the brightness of Center within Black Screen.		-	
			Others		Mura is basically judged OK if invisible with 5%ND Filter.			

	No	ITEM			Max. acceptable number	Unit	Note
Operating and Non-operating inspection	3	Stain inclusion Line shape (W : width (mm) L : length (mm))	W≦0.02	L<0.3	Ignore	pcs	7)
			W≦0.04	L≦4.0	8		
				L>4.0	0		
			W≦0.08	L≦2.0	8		
				L>2.0	0		
			W>0.08	-	(See dot shape)		
	4	Stain inclusion Dot shape (D : ave. dia (mm))	D≦0.25		Ignore	pcs	7)
			D≦0.4		8		
			D>0.4		0		
Non-operating inspection	5	Bubbles in polarizer (D : ave. dia (mm))	D≦0.2		Ignore	pcs	8)
			D≦0.3		10		
			D>0.3		0		
	6	Scratch on polarizer Line shape (W : width (mm) L : length (mm))	W≦0.05	L : Ignore	Ignore	pcs	8)
			W≦0.07	L≦2	10		
				L>2	0		
			W>0.07	-	0		
	7	Scratch on polarizer Dot shape (D : ave. dia (mm))	D≦0.2		Ignore	pcs	8)
			D≦0.3		10		
			D>0.3		0		

Note 1) Display black raster pattern.

2) Sparkle mode :

(a) bright defect

G≧344 (check as compared with 344/1023 tone dot using black screen).

R≧344 (check as compared with 344/1023 tone dot using black screen).

B≧450 (check as compared with 450/1023 tone dot using black screen).

(b) low bright defect

344＞G≧124 (check as compared with 344/1023 and 124/1023 tone dot using black screen).

344＞R≧204 (check as compared with 344/1023 and 204/1023 tone dot using black screen).

450＞B≧364 (check as compared with 450/1023 and 364/1023 tone dot using black screen).

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 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.

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. Never 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 cover case must have sufficient strength s Torque correction and chage of paint area

(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.

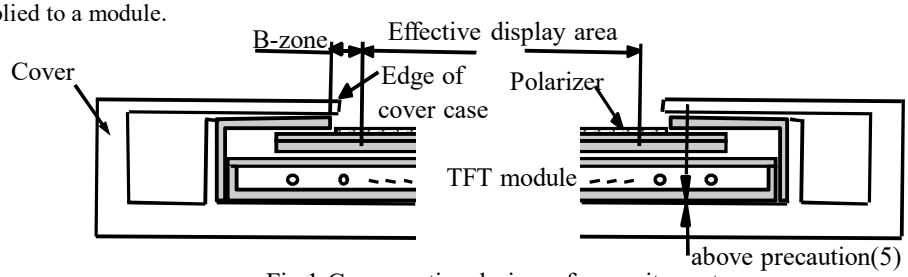


Fig.1 Cross sectional view of a monitor set

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

(7) A transparent protective plate should be added on the display area of a module in order to protect a polarizer and TFT cell.The transparent protective plate should have sufficient strength so that the plate can not touch a module by external force.

(8) Materials included acetic acid and choline should not be used for a cover case as well as other parts and boards near a module. Acetic acid attacks a polarizer. Choline attacks electric circuits due to electro-chemical reaction.

(9) The polarizer on a TFT cell should carefully be handled due to its softness, and should not be touched, pushed or rubbed with glass, tweezers or anything harder than HB pencil lead. The surface of a polarizer should not be touched and rubbed with bare hand, greasy clothes or dusty clothes.

(10) The surface of a polarizer should be gently wiped with absorbent cotton, chamois or other soft materials slightly contained petroleum benzene when the surface becomes dirty. Normal-hexane or Isopropyl alcohol as cleaning chemicals is recommended in order to clean adhesives which fix front/rear polarizers on a TFT cell. Other cleaning chemicals such as acetone, toluen and alcohol should not be used to clean adhesives because they cause chemical damage to a polarizer.

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

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

(13) 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.

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

(15) Do not put foreign material into module because of failure potential.
The failure by such cause can not be guaranteed.

(16)The module should be transported in upstanding state.

(17)It may cause screen light leakage with black screen dew to change of environmental temperature.

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 mis-operation of a module. The level of spike noise should be as follows:

$$-200\text{mV} \leqq \text{over- and under- shoot of VDD} \leqq +200\text{mV}$$

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 trou Torque correction and chage of paint area
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. Modules should be stored at 0 to 35℃ at 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 handling protection film

(1) The protection film for polarizers should be pealed off slowly and carefully by persons who are electrically grounded with adequate methods such as a list band. Besides, ionized air should be blown over during peeling action. Dusts on a polarizer should be blown off by an ionized nitrogen gun and so on.
(2) The protection film should be peeling off without rubbing it to the polarizer. Because, if the film is rubbed together with the polarizer, since the film is attached to the polarizer with a small amount of adhesive, the adhesive may remain on a polarizer.
(3) The module with protection film should be stored on the conditions explained in 10.5 (1). However, in case that the storage time is too long, adhesive may remain on a polarizer even after a protection film is peeled off. Besides, in case that a module is stored at higher temperature and/or higher humidity, adhesive may remain on a polarizer. The remained adhesive may cause non-uniformity of display image.
(4) The adhesive can be removed easily with Normal-Hexane or Isopropyl alcohol. The remained adhesive or its vestige on the polarizer should be wiped off with absorbent cotton or other soft materials such as chamois slightly contained Normal-Hexane or Isopropyl alcohol.

9.7 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.

9.8 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.

9.9 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.

9.10 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.

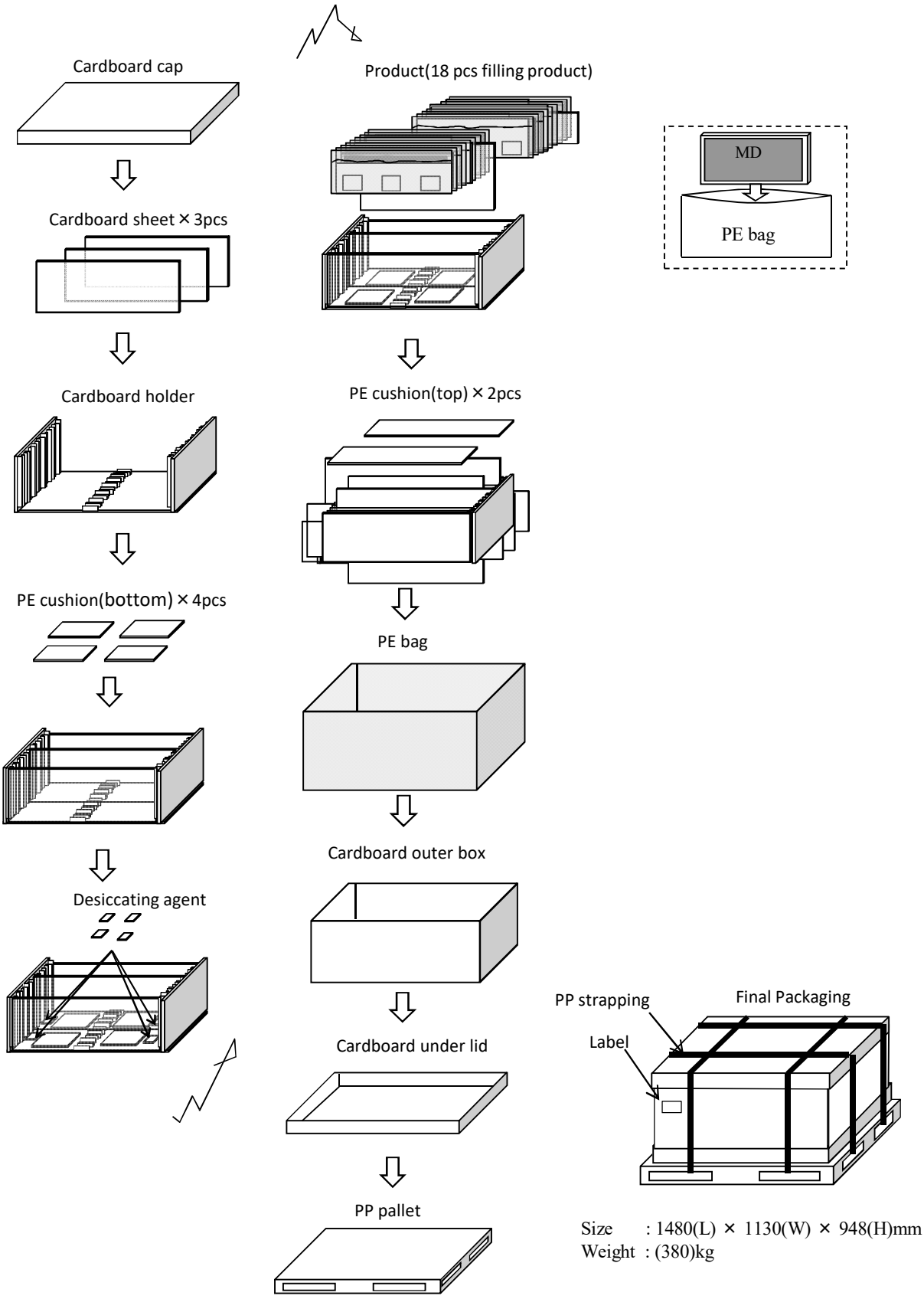
9.11 Others

Electrical components which may not affect electrical performance are subjective to change without notice because of their availability.

10. PACKING

10.1 Precaution to handling and mounting

1) Standard packing specification



Size : 1480(L) × 1130(W) × 948(H)mm
Weight : (380)kg

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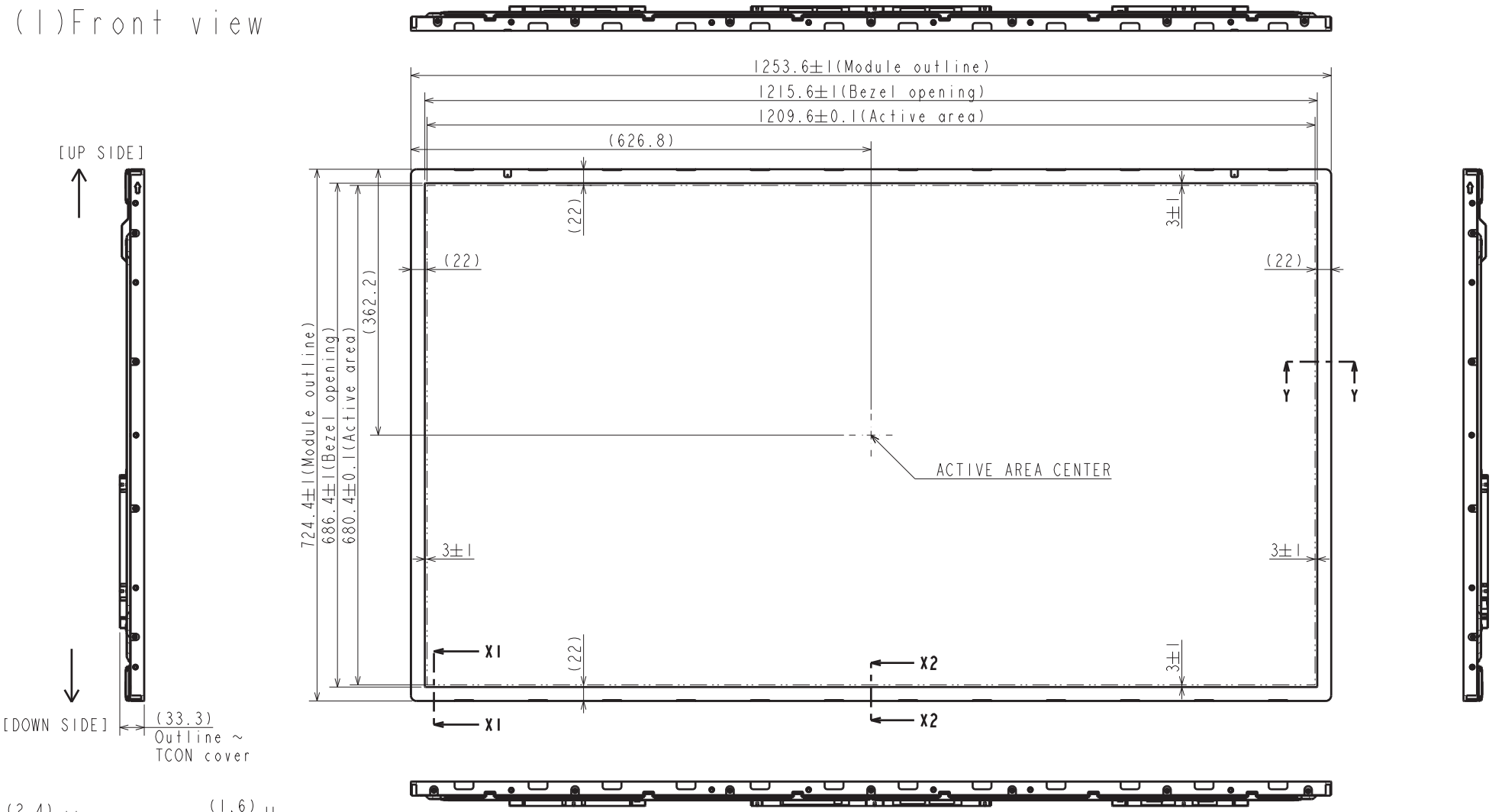
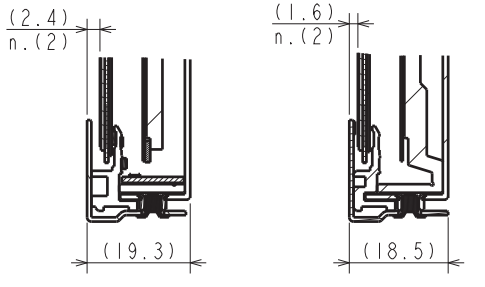
11. RELIABILITY TEST

No.	Item		condition	Period	Criteria for judgment
1	Low Temperature / Operating		Ta=0℃	500h	No malfunction
2	High Temperature / Operating		Ta=45℃	500h	
3	High Temperature High Humidity / Operating		40℃ 80%RH	500h	
4	Low Temperature / Storage		Ta=-20℃	240h	
5	High Temperature / Storage		Ta=70℃	240h	
6	High Temperature High Humidity / Storage		40℃ 80%RH	240h	
7	Heat shock		-25/70℃ 30min./30min.	100cy.	
8	Heat shock test for solder		-35/85℃ 30min./30min.	200cy.	
9	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.	-	No Latch-up
		I/F connector pins	C = 200 pF, R = 0 ohm Environment: 15-35℃/30-60%RH V input : +/- 100V Aerial discharge control signals.	-	No destruction

Dimension Outline

(1)Front view





Note1) The dimension in parenthesis is a reference value.
2) The measuring method depend on Panasonic Liquid Crystal Display CO.,Ltd standard.
3) The customer mount M4 ; Torque. MAX 17kgf·cm

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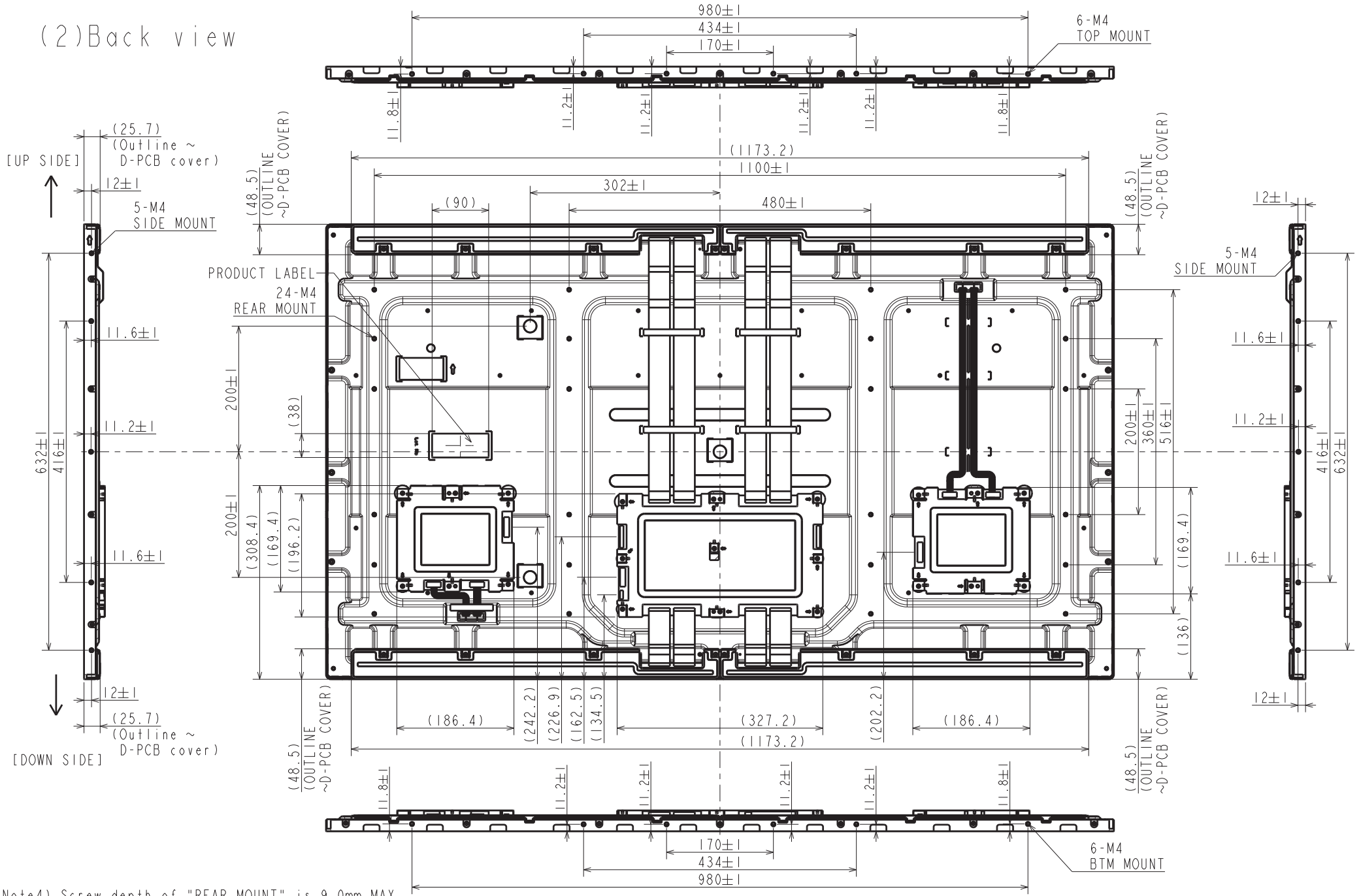
(2)Back view



Note4) Screw depth of "REAR MOUNT" is 9.0mm MAX.
5) Screw depth of "SIDE MOUNT" is 6.7mm MAX.
6) Screw depth of "TOP/BTM MOUNT" is 5.0mm MAX.

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