Tentative

Panasonic Liquid Crystal Display Co.,Ltd.

TECHNICAL DATA

VVX21F136J00

CONTENTS

RECORD OF REVISION

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DESCRIPTION

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

Product Name : VVX21F136J00

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

General Specifications

Effective display area	: (H) 432 × (V) 324	(mm)
Number of pixels	: (H) 1,600 × (V) 1,200	(pixels)
Pixel pitch	: (H) 0.270 × (V) 0.270	(mm)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Anti-Glare	
Number of colors	: 16,777,216	(colors)
Viewing angle range	: Wide version (Horizontal & Vertical : 178° at φ=0°,90°,180°,270°, CR≧10)	
Input signal	: LVDS (LVDS : Low voltage differential signaling)	
Backlight	: 55 pcs of LED (LED : Light-emitting diode)	
External dimensions	: Typ. (H) 456 × (V) 349.5 × (T)22	(mm)
Weight	: Typ. 2750	(g)

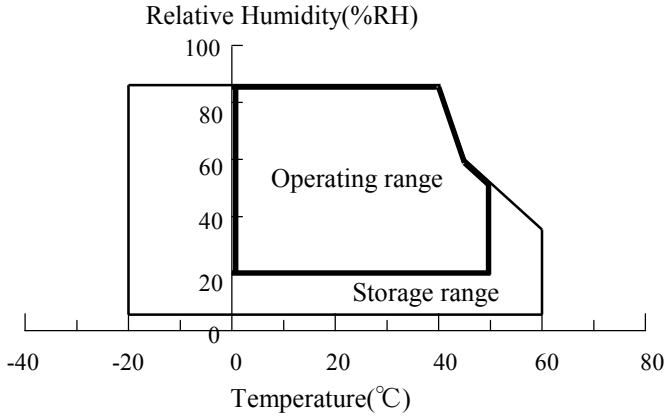
1. ABSOLUTE MAXIMUM RATINGS

1. 1 Environmental Absolute Maximum Ratings

ITEM	Operating		Storage		UNIT	NOTE
	Min.	Max.	Min.	Max.		
Temperature	0	50	-20	60	℃	1),5),6)
Humidity	2)		2)		%RH	1)
Vibration	-	4.9(0.5 G)	-	14.7(1.5 G)	m/s^2	3)
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	-

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) 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.

1. 2 Electrical Absolute Maximum Ratings

(1)TFT-LCD module GND=0V

ITEM	SYMBOL	Min.	Max.	UNIT	NOTE
Power supply voltage	VDD	-0.3	6.5	V	-
Input Voltage for logic	V1	-0.3	4.0	V	1)
Electrostatic Durability	VESD0	±100		V	2),3)
	VESD1	±4		kV	4),5)

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

2) Constant discharge: 200pF-0Ω (GRD=0V), Environment: 15-35℃/30-60%RH, Contact Discharge.

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

4) Constant discharge: 150pF-330Ω, Environment: 15-35℃/30-60%RH, Aerial discharge.

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

(2) Backlight unit

ITEM	SYMBOL	Max.	UNIT	NOTE
Temperature Junction of LED	Tj	120	℃	1)
Forward Current	If	90	mA/string	2)

Note 1) The specification shall be applied to each LED.

2) The specification shall be applied at connector pins for LED at start-up.

2. INITIAL OPTICAL CHARACTERISTICS

The following optical characteristics are measured under stable conditions. It takes about 30 minutes to reach stable conditions. The measuring point is the center of display area unless otherwise noted.

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

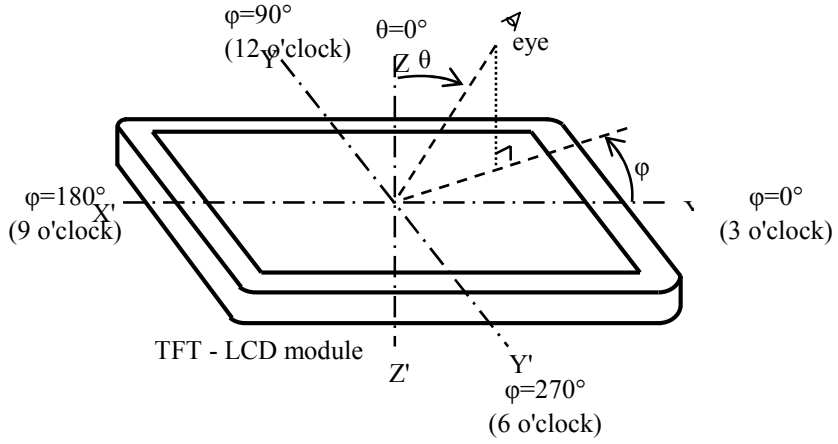
Measuring equipment : CS-1000A, or equivalent

Ambient Temperature =25 ℃ , f V=60 Hz ,

Ifc = 60mA/string

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		350	440	-	cd/m^2	-
Brightness uniformity		Buni		-	-	25	%	4)
Color chromaticity (CIE)	Red	x		0.625	0.655	0.685	-	【Gray scale =255】
		y		0.300	0.330	0.360		
	Green	x		0.275	0.305	0.335		
		y		0.595	0.625	0.655		
	Blue	x		0.120	0.150	0.180		
		y		0.045	0.075	0.105		
	White	x		0.270	0.300	0.330		
		y		0.310	0.340	0.370		
Variation of color position (CIE)	Red	Δx	θ= 50 ° φ= 0 °, 90 °, 180 °, 270 ° 1)	-	-	0.04	-	5) 【Gray scale =255】
		Δy		-	-	0.04		
	Green	Δx		-	-	0.04		
		Δy		-	-	0.04		
	Blue	Δx		-	-	0.04		
		Δy		-	-	0.04		
	White	Δx		-	-	0.04		
		Δy		-	-	0.04		
Contrast ratio at 89 °		CR89	φ=0°,90°, 180°,270° 6)	10	-	-	-	Estimated value
Image sticking		-	Mosaic pattern	Invisible			-	7)
Gray Scale Level		-	θ= 0 ° 1)	-			-	8)

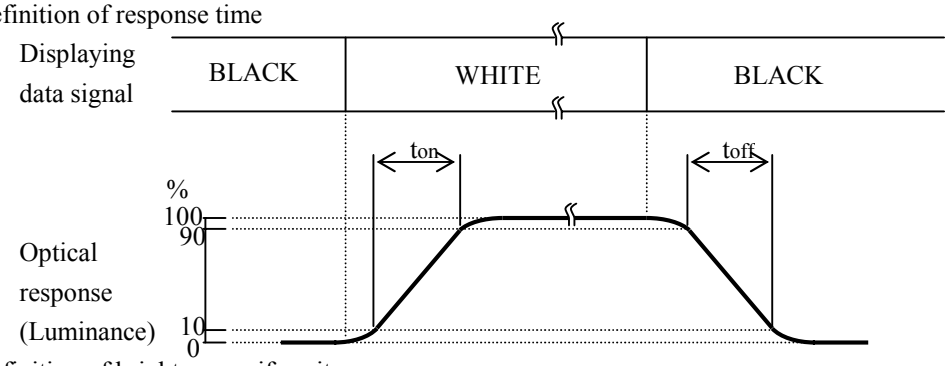
Note 1) Definition of viewing angle



Note 2) Definition of contrast ratio (CR)

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

3) Definition of response time



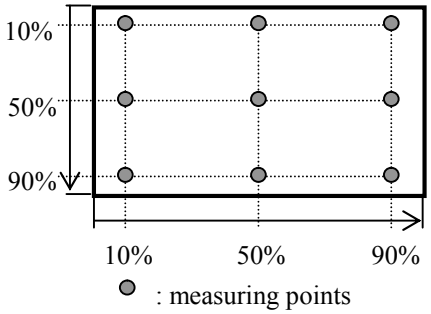
4) Definition of brightness uniformity

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

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

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°.

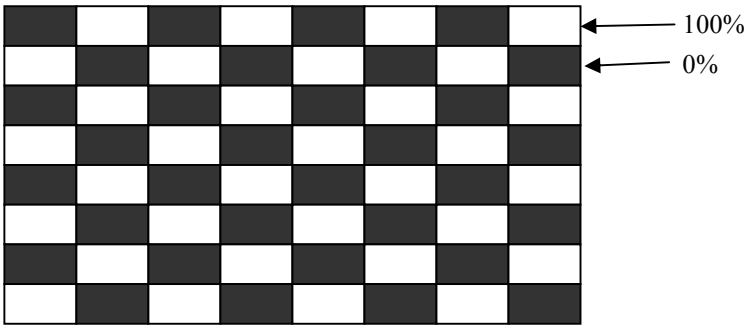
6) Contrast ratio at 89 °

Evaluetion conditions are on horizontal & vertical axis

7) Image sticking

Condition : Operating mosaic pattern for 2 hours and gray (128/255 Gray Scale) for 1 hour.

Mosaic pattern



8) Gray Scale Level (Typ.)

Gray Level	Relative Brightness (%) (Typ.)
0	0.1%
16	0.3%
32	1.0%
48	2.4%
64	4.6%
80	7.7%
96	11.6%
112	16.1%
128	21.5%
144	28.4%
160	36.0%
176	44.5%
192	53.7%
208	63.9%
224	74.9%
240	88.1%
255	100.0%

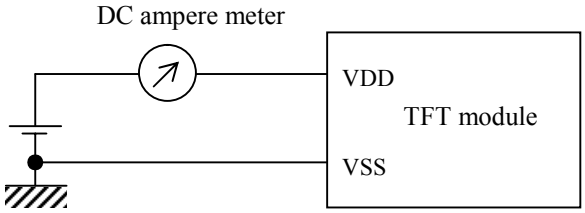
3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

Ta = 25 ℃ , GND = 0 V

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage	VDD	4.5	5.0	5.5	V	-
Power supply current	IDD	-	0.75	1.15	A	1),2)
Ripple voltage of power supply	VDDR	-	-	500	mV	-

Note 1) fV=60.0Hz, DCLK=65.125MHz, VDD=5.0V, and display pattern is white.



2) Current fuse is built in a module. Current capacity of power supply for VDD should be larger than 4[A], so that the fuse can be opened at the trouble of electrical circuit of module.

3. 2 Backlight unit

Ta = 25 ℃ , Vss = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Forward Currnet (One LED Assembly)	Anode	Ifa	-	300	315	mA/array	-
	Cathode	Ifc	-	60	63	mA/string	-
Forward Voltage	String	Vf	60.7	65.2	69.6	V	Ifc=60mA/string
	Variation	Vf(unit)	-	-	3	V	One BL unit
Power Consumption		Pbl	-	20	21	W	Ifc=60mA/string
LED Life time		-	30000	-	-	h	2)

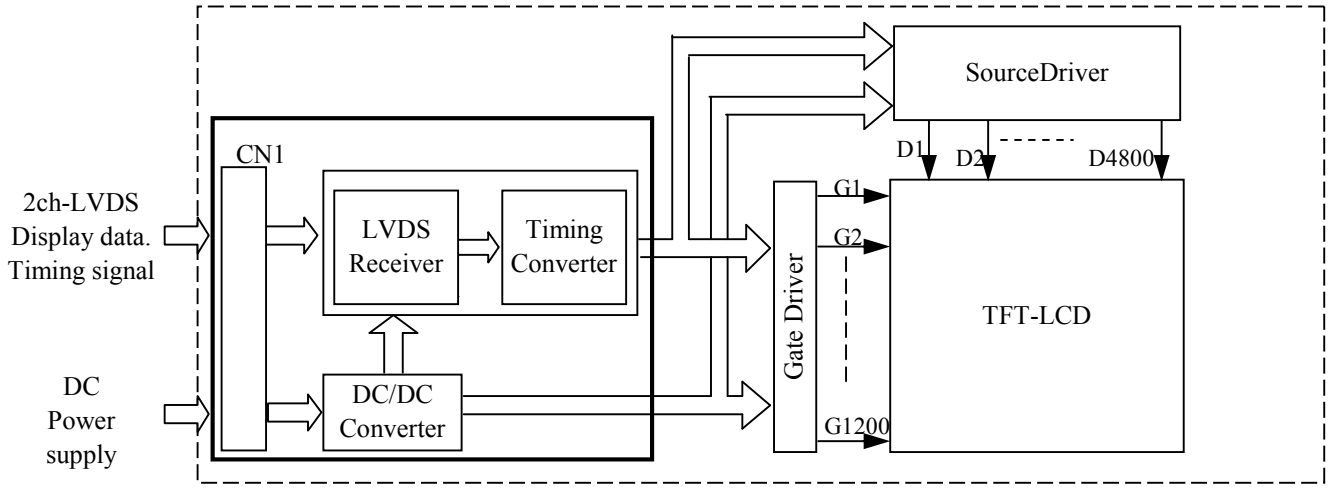
One Backlight Unit : 1 LED Array.
One LED Array : 5 LED String.
One LED String : 11 LED package.

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

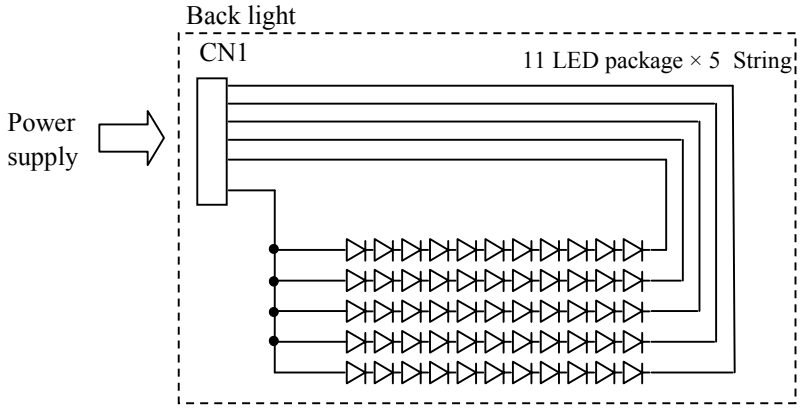
2) Life time of a LED is defined as follows. The life is determined as the time at which brightness of the LED is 50 % compared to that of initial value at that typical forward current on condition of continuous operating at 25 ± 2 ℃.

4. BLOCK DIAGRAM

4. 1 TFT-LCD module



4. 2 Backlight unit



5. INTERFACE PIN ASSIGNMENT

5. 1 TFT-LCD module

<CN1:JAE FI-X30SSLA-HF>

PIN No.	SYMBOL	DESCRIPTION	NOTE
1	RxA0-	LVDS Odd Pixel Data	1)
2	RxA0+		
3	RxA1-	LVDS Odd Pixel Data	1)
4	RxA1+		
5	RxA2-	LVDS Odd Pixel Data	1)
6	RxA2+		
7	GND	Ground(0V)	2)
8	RxAC-	LVDS Odd Pixel Clock	1)
9	RxAC+		
10	RxA3-	LVDS Odd Pixel Data	1)
11	RxA3+		
12	RxB0-	LVDS Even Pixel Data	1)
13	RxB0+		
14	GND	Ground(0V)	2)
15	RxB1-	LVDS Even Pixel Data	1)
16	RxB1+		
17	GND	Ground(0V)	2)
18	RxB2-	LVDS Even Pixel Data	1)
19	RxB2+		
20	RxBC-	LVDS Even Pixel Clock	1)
21	RxBC+		
22	RxB3-	LVDS Even Pixel Data	1)
23	RxB3+		
24	GND	Ground(0V)	2)
25	NC	No Connection	-
26	NC	No Connection	-
27	NC	No Connection	-
28	VDD	Power Supply	3)
29	VDD		
30	VDD		

1) RxAn+/-, RxBn+/-, (n=0～5), CLKA+/- and CLKB+/- should be wired by side-by-side FPC patterns, res
2) All GND pins shall be grounded. Metal bezel is internally connected to GND.
3) All VDD pins shall be connected to +5.0V(Typ.).

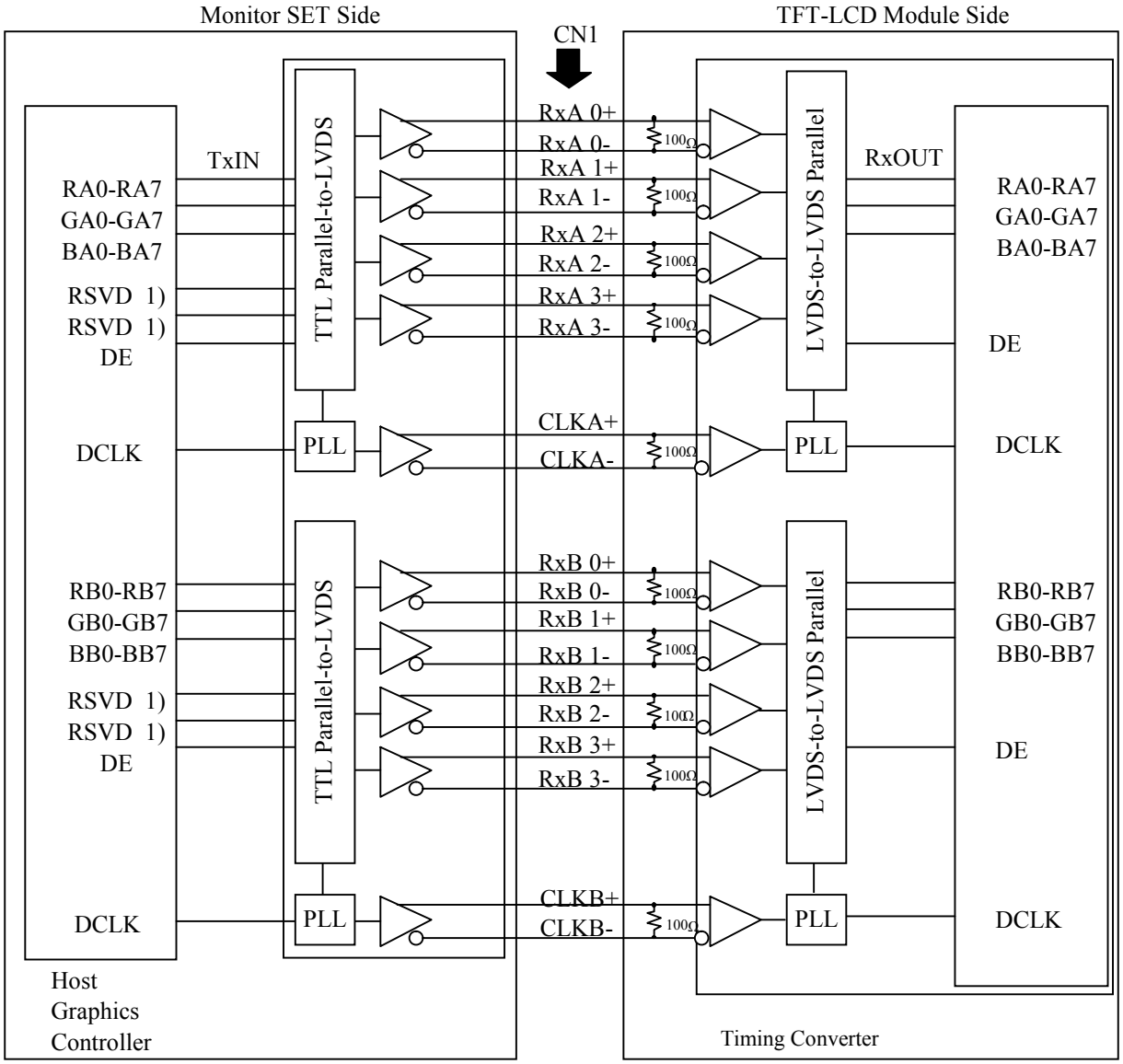
5. 2 Back light unit

CN1:(JST PHR-10)

(Matching connector : JST S10B-PH)

PIN No.	DESCRIPTION	NOTE
1	Cathode	-
2	Cathode	-
3	Cathode	-
4	Cathode	-
5	Cathode	-
6	NC	-
7	NC	-
8	NC	-
9	Anode	-
10	Anode	-

5. 3 Block diagram of interface



RA0～RA7, RB0～RB7	: Pixel R Data	(7; MSB, 0; LSB)
GA0～GA7, GB0～GB7	: Pixel G Data	(7; MSB, 0; LSB)
BA0～BA7, BB0～BB7	: Pixel B Data	(7; MSB, 0; LSB)
DE	: Data Enable	

Note 1) The system must have the transmitter to drive the module.

2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

5. 4 LVDS interface

	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER		TFT CONTROL
		PIN	INPUT	Monitor Set	TFT-LCD	PIN	OUTPUT	INPUT
24bit	RA0/RB0	51	Tx IN0	TA OUT0+	RxA/B 0+	27	Rx OUT0	RA0/RB0
	RA1/RB1	52	Tx IN1			29	Rx OUT1	RA1/RB1
	RA2/RB2	54	Tx IN2			30	Rx OUT2	RA2/RB2
	RA3/RB3	55	Tx IN3			32	Rx OUT3	RA3/RB3
	RA4/RB4	56	Tx IN4			33	Rx OUT4	RA4/RB4
	RA5/RB5	3	Tx IN6	TA OUT0-	RxA/B 0-	35	Rx OUT6	RA5/RB5
	GA0/GB0	4	Tx IN7			37	Rx OUT7	GA0/GB0
	GA1/GB1	6	Tx IN8	TA OUT1+	RxA/B 1+	38	Rx OUT8	GA1/GB1
	GA2/GB2	7	Tx IN9			39	Rx OUT9	GA2/GB2
	GA3/GB3	11	Tx IN12			43	Rx OUT12	GA3/GB3
	GA4/GB4	12	Tx IN13			45	Rx OUT13	GA4/GB4
	GA5/GB5	14	Tx IN14			46	Rx OUT14	GA5/GB5
	BA0/BB0	15	Tx IN15	TA OUT1-	RxA/B 1-	47	Rx OUT15	BA0/BB0
	BA1/BB1	19	Tx IN18			51	Rx OUT18	BA1/BB1
	BA2/BB2	20	Tx IN19	TA OUT2+	RxA/B 2+	53	Rx OUT19	BA2/BB2
	BA3/BB3	22	Tx IN20			54	Rx OUT20	BA3/BB3
	BA4/BB4	23	Tx IN21			55	Rx OUT21	BA4/BB4
	BA5/BB5	24	Tx IN22			1	Rx OUT22	BA5/BB5
	HSYNC or RSVD1)	27	Tx IN24			3	Rx OUT24	HSYNC or RSVD1)
	VSYNC or RSVD1)	28	Tx IN25	TA OUT2-	RxA/B 2-	5	Rx OUT25	VSYNC or RSVD1)
	DE/DE	30	Tx IN26			6	Rx OUT26	DE/DE
	RA6/RB6	50	Tx IN27	TA OUT3+	RxA/B 3+	7	Rx OUT27	RA6/RB6
	RA7/RB7	2	Tx IN5			34	Rx OUT5	RA7/RB7
	GA6/GB6	8	Tx IN10			41	Rx OUT10	GA6/GB6
	GA7/GB7	10	Tx IN11			42	Rx OUT11	GA7/GB7
	BA6/BB6	16	Tx IN16			49	Rx OUT16	BA6/BB6
	BA7/BB7	18	Tx IN17	TA OUT3-	RxA/B 3-	50	Rx OUT17	BA7/BB7
	RSVD 1)	25	Tx IN23			2	Rx OUT23	RSVD 1)
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLKA/B IN+ RxCLKA/B IN-	26	RxCLK OUT	DCLK

RA0～RA7, RB0～RB7 : Pixel R Data (7; MSB, 0; LSB)
GA0～GA7, GB0～GB7 : Pixel G Data (7; MSB, 0; LSB)
BA0～BA7, BB0～BB7 : Pixel B Data (7; MSB, 0; LSB)
DE : Data Enable

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

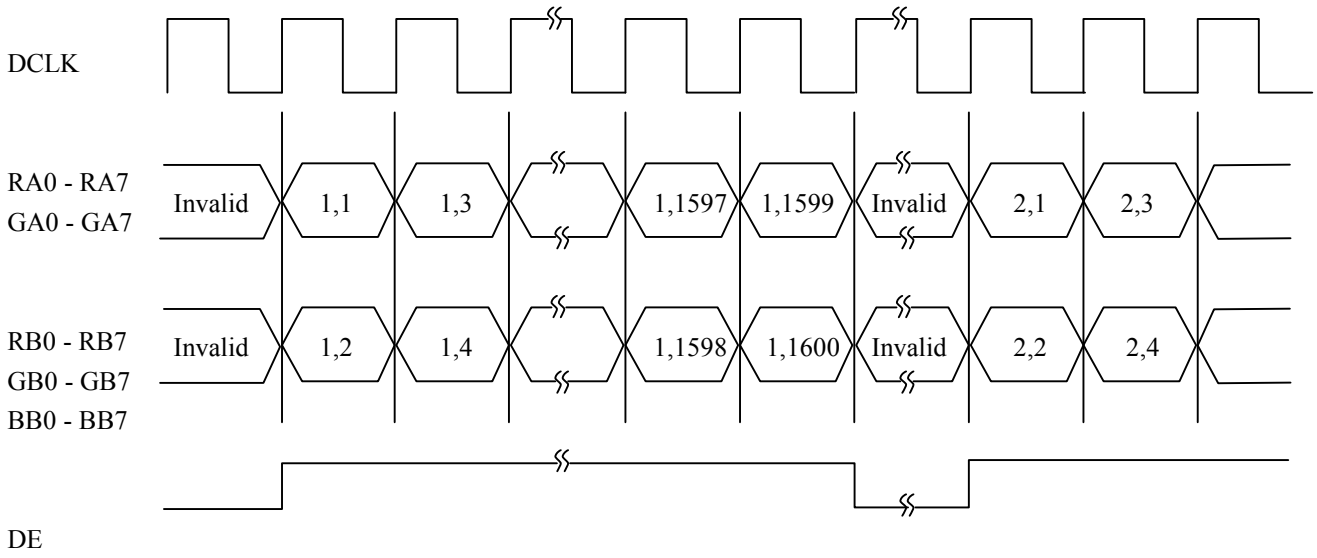
5. 5 Correspondence between input data and display image

Display data of adjacent one pixel is latched during one cycle of DCLK.

RA	(1,1) GA	BA	RB	(1,2) GB	BB

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

1 , 1	1 , 2	1 , 3	- -	1 , 1600
2 , 1	2 , 2	2 , 3	- -	2 , 1600
3 , 1	3 , 2	3 , 3	- -	3 , 1600
1200 , 1	1200 , 2	1200 , 3		1200, 1600



5. 6 Relationship between display colors and input signals

Color		Input	Red Data								Green Data								Blue Data							
			R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
			MSB							LSB	MSB							LSB	MSB							LSB
Basic Color		Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
		Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
		Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
		Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
		White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red		Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Red (1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Red (2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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		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
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		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
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		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 :

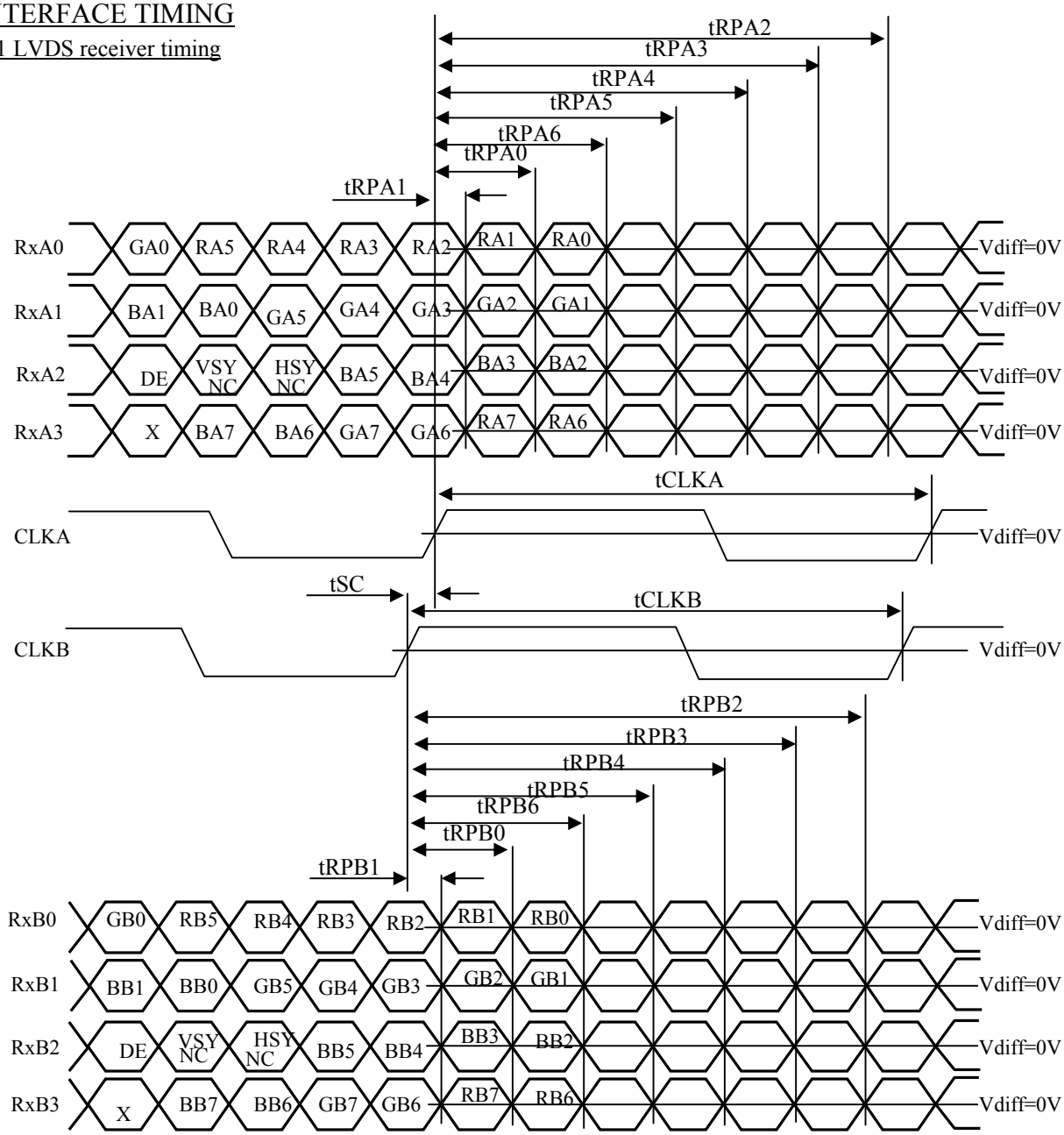
Color(n) ・・・・Number in parenthesis indicates gray scale level.

Larger n corresponds to brighter level.

2) Data : 1 : High, 0 : Low

6. INTERFACE TIMING

6. 1 LVDS receiver timing



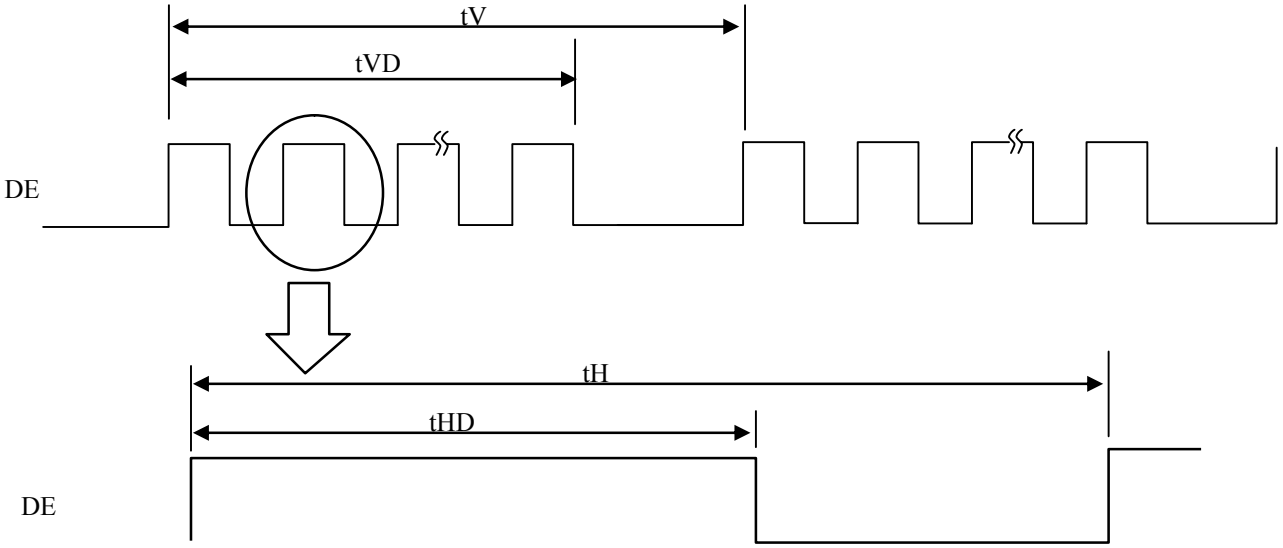
Rx*0=(Rx*0+)-(Rx*0-)　　Rx*3=(Rx*3+)-(Rx*3-)

Rx*1=(Rx*1+)-(Rx*1-)　　CLK=(CLK+)-(CLK-)

Rx*2=(Rx*2+)-(Rx*2-)

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
CLK	Frequency	DCLK	62.0	65.125	67.5	MHz	-
	CLK Skew	tSC	- 4.0	0	+ 4.0	ns	-
Rx*0 Rx*1 Rx*2 Rx*3	0 data position	tRP0	1/7tCLK - 0.4	1/7tCLK	1/7tCLK + 0.4	ns	-
	1st data position	tRP1	- 0.4	0	+ 0.4		
	2nd data position	tRP2	6/7tCLK - 0.4	6/7tCLK	6/7tCLK + 0.4		
	3rd data position	tRP3	5/7tCLK - 0.4	5/7tCLK	5/7tCLK + 0.4		
	4th data position	tRP4	4/7tCLK - 0.4	4/7tCLK	4/7tCLK + 0.4		
	5th data position	tRP5	3/7tCLK - 0.4	3/7tCLK	3/7tCLK + 0.4		
	6th data position	tRP6	2/7tCLK - 0.4	2/7tCLK	2/7tCLK + 0.4		

6. 2 Syncronization signal timing

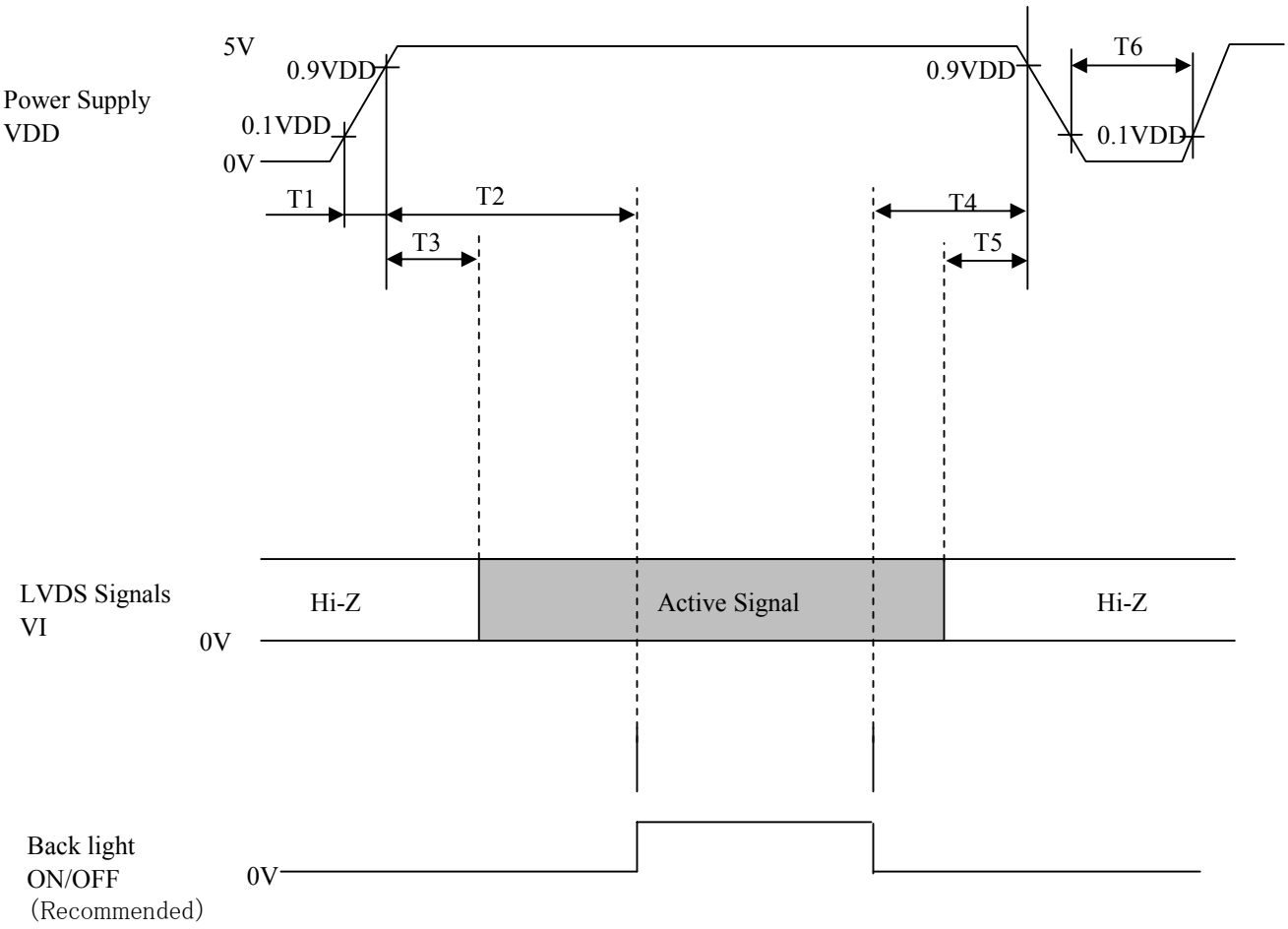


Note 1) The timing of DCLK to other signals conforms to the specifications of LVDS transmitter.

2pxl/clk

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
DE	Vertical Frequency	fV	58	60	63	Hz	-
	Vertical Period	tV	1229	1233	−	tH	-
	Vertical Valid	tVD		1200		tH	-
	V-Blanking	-	29	33	−	tH	-
	Horizontal Frequency	fH	71.5	74	78	kHz	-
	Horizontal Period	tH	850	880	940	tCLK	-
	Horizontal Valid	tHD		800		tCLK	-
	H-Blanking	-	50	80	140	tCLK	-

6.3 Timing between interface signals power supply



0	≦ T1 ≦ 10	0	≦ T4
500	≦ T2	0	≦ T5
10	≦ T3	1000	≦ T6

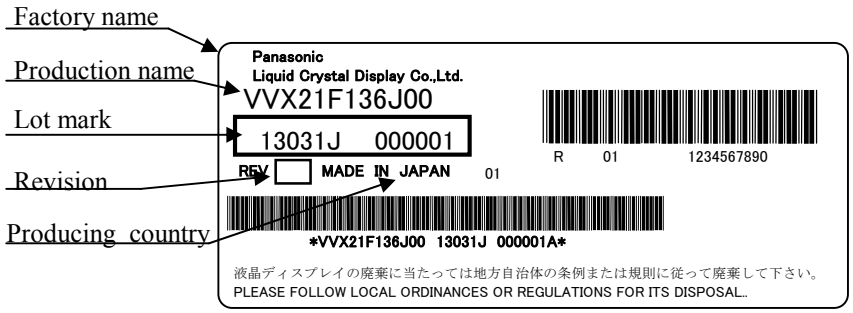
Unit : ms

7. LABEL FORMAT

7.1 Label

The label is on the metallic bezel as shown in 12. Dimensional Outline.

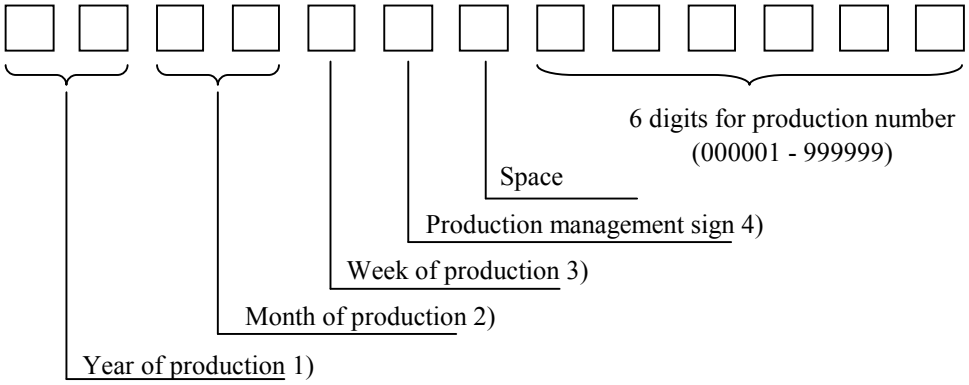
The style of character will be changed without notice.



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
12	2012
13	2013
14	2014

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

4) J : Made by Panasonic Liquid Crystal Display Co., Ltd.

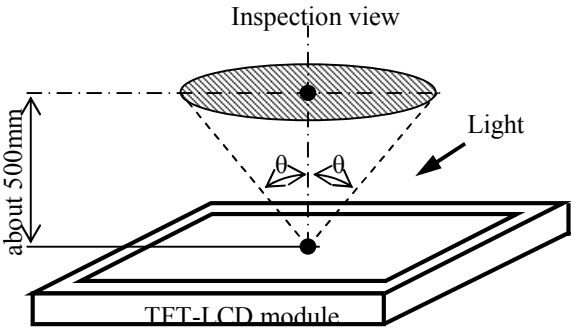
8. COSMETIC SPECIFICATIONS

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 non-operating inspection
when operating MURA inspection
θ≦5° : when operating inspection

b) Inspection should be executed only from front side and only A-zone.
Cosmetic of B-zone and C-zone are ignore.
(refer to 8.2 Definition of zone)



(2) Environmental

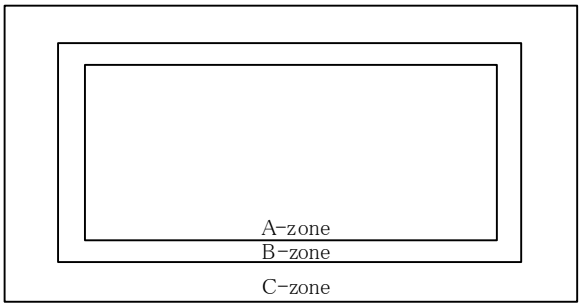
a) Temperature : 25 degrees

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	12	pcs	1),3)
				2-dots	0	-	Units	1),4)
				3-dots	0	-		
			Black mode	1-dot	7		pcs	2),3)
				2-dots	1		Units	2),4),9)
				3-dots	0			
				Density	3		pcs/φ20mm	2),5)
				Total	7		pcs	2)
	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. Limit sample is set up if needed after deliberations.			

	No.	ITEM			Max. acceptable number		Unit	Note
					Bright defect	Low bright defect		
Operating inspection	3	Stain inclusion Line shape (W : width (mm) L : length (mm))	W≦0.01	L< 0.3	Ignore		pcs	6)
			W≦0.1	L≦5.0	3			
				L>5.0	0			
			W>0.1	-	0			
	4	Stain inclusion (Dot shape D : ave. dia (mm))	D≦0.22		Ignore		pcs	6)
			D≦0.5		3			
			D>0.5		0			
	5	Scratch on polarizer Line shape (W : width (mm) L : length (mm))	W≦0.01	L≦0.3	Ignore		pcs	7)
			W≦0.07	L≦0.5	3			
			W>0.07	L>5.0	0			
	6	Scratch on polarizer (Dot shape D : ave. dia (mm))	D≦0.2		Ignore		pcs	7)
			D≦0.5		3			
			D>0.5		0			
Non operating inspection	7	Bubbles, peeling in polarizer (D : ave. dia (mm))	D≦0.2		Ignore		pcs	7)
			D≦0.5		10			
			D>0.5		0			
	8	Wrinkles on polarizer			Serious one is not allowed.		-	-

Note

1) Sparkle mode :

bright defect	G≧96	(Gray scale 0～255)
	R≧96	
	B≧96	
low bright defect	96＞G≧25	
	96＞R≧25	
	96＞B≧49	

2) Black mode : brightness of dot is less than 70% at white. (visible to eye)
3) 1 dot : defect dot is isolated, not attached to other defect dot.
4) N dots : N defect dots are consecutive. (N means the number of defects dots)
5) Density : number of defect dots inside φ20mm
6) Those stains which can be wiped out easily are acceptable.
7) Polarizer area inside of B-zone is not applied.
8) No major (serious) defects when viewed in gray scale mode.
9) 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 ignored.

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 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.

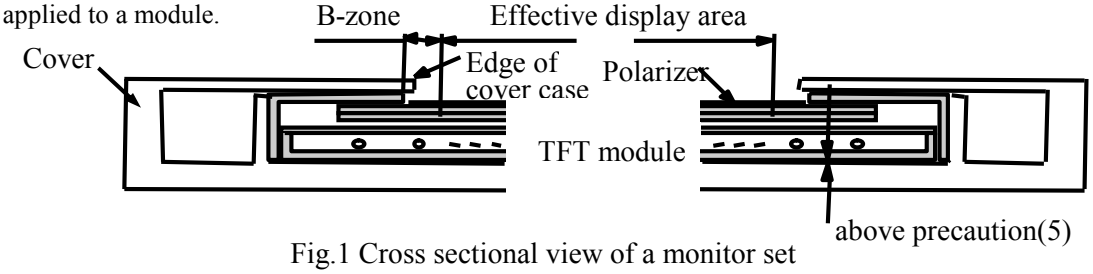


Fig.1 Cross sectional view of a monitor set

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

(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.

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:

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

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. 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 9.5 (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.

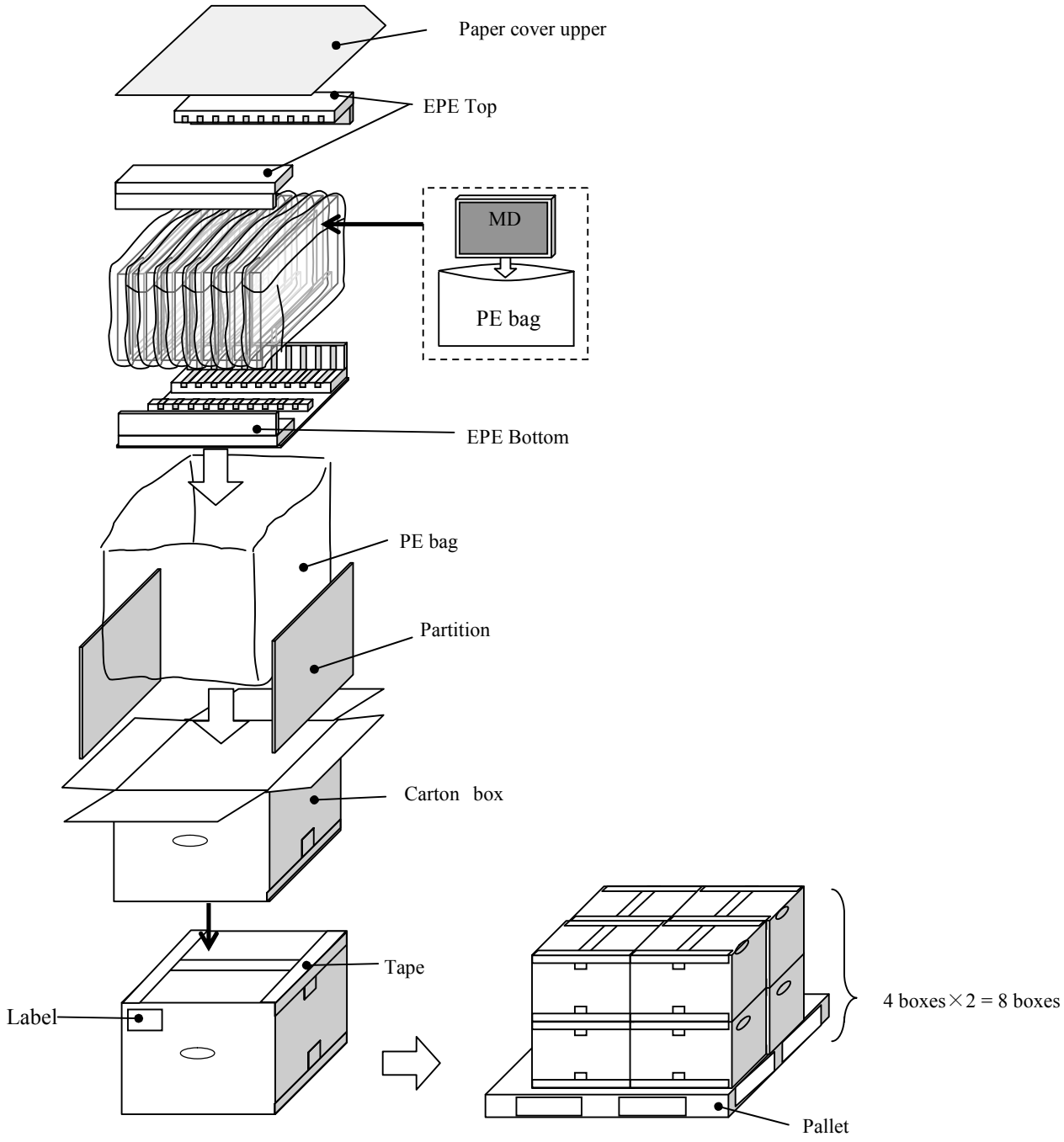
9.11 Others

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

Standard packing specification

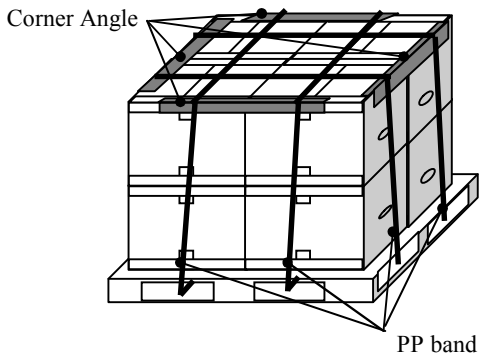


1 Box

Packing Size	550(L)×540(W)×470(H)mm
Gross Weight	33kg/Box
MD QTY	10pcs

1 Pallet Total

Packing Size	1200(L)×1100(W)×1065(H)mm
Gross Weight	275kg/PL
MD QTY	10pcs×8boxes = 80pcs/PL



11. Reliability test

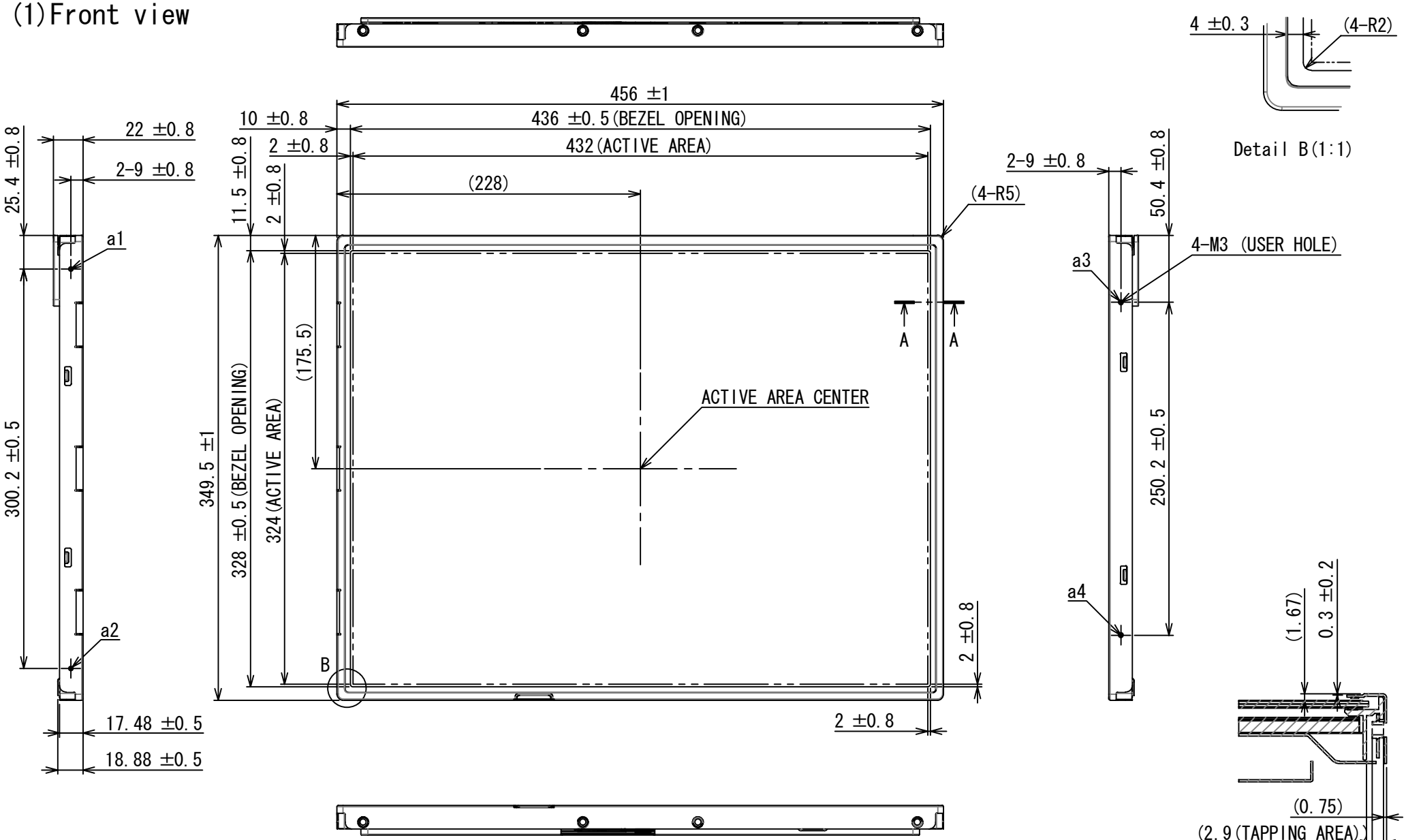
No.	Item	condition	Period	
			determination	end
1	Low Temperature / Operating	Ta=0℃	500h	1000h
2	High Temperature / Operating	Ta=45℃	500h	1000h
3	High Temperature High Humidity / Operating	65℃ 85%RH	500h	500h
4	Low Temperature / Strage	Ta=-20℃	500h	1000h
5	High Temperature / Strage	Ta=70℃	500h	1000h
6	High Temperature High Humidity / Strage	40℃ 80%RH	500h	1000h
7	Heat shock	-25/70℃ 30min./30min.	100cy.	200cy.
8	Heat shock test for solder	-35/85℃ 30min./30min.	200cy.	500cy.

Result Evaluation

Display function should be kept.

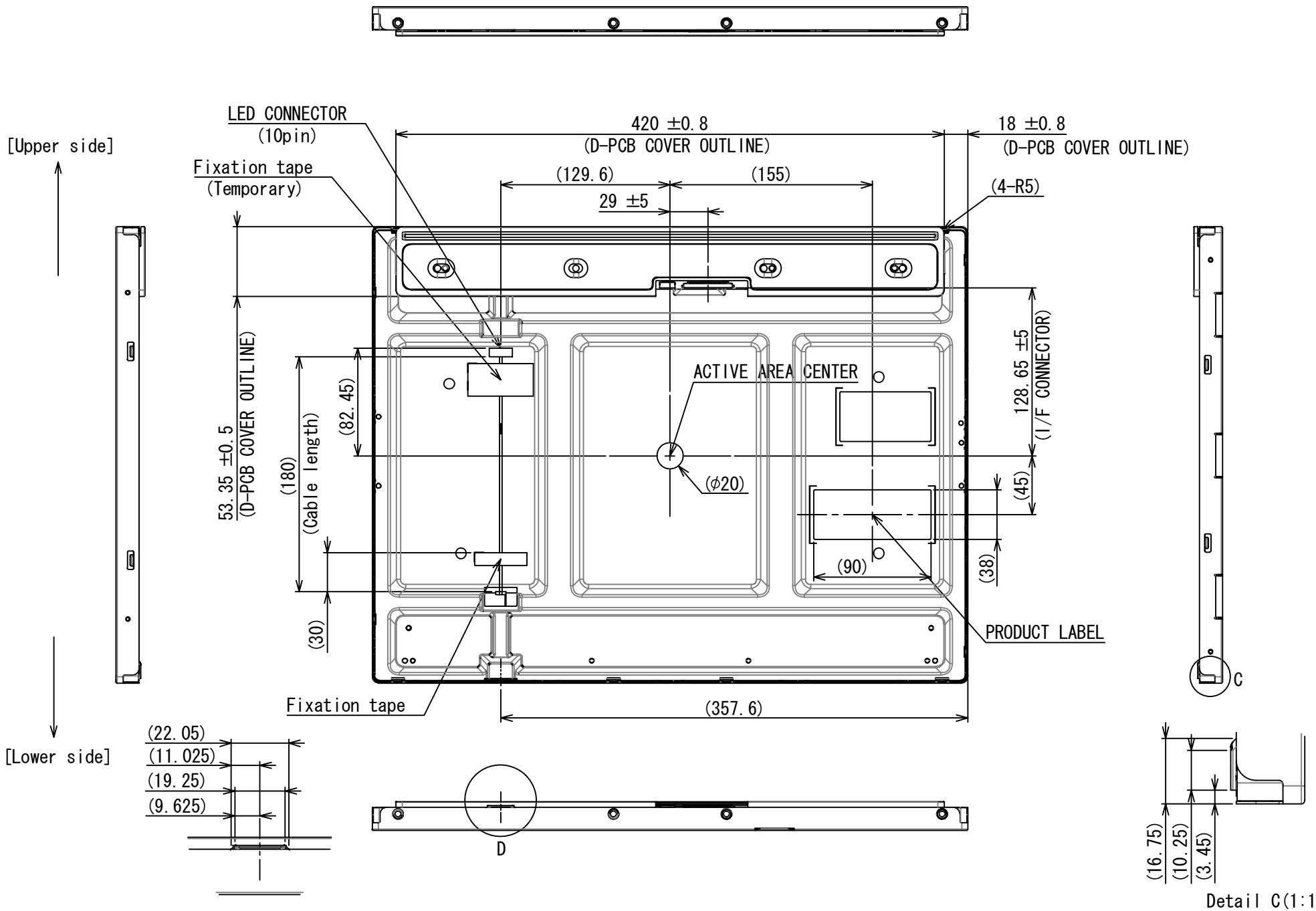
12. Dimensional Outline

(1)Front view



Note
1) 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 reccomended torque of M3(USER HOLE) is 5.0±0.5kgf・cm(0.49±0.049N・m).

(2)Back view



Detail D(2:3)

Detail C(1:1)

Panasonic Liquid Crystal Display Co., Ltd	Date	Jen.21,2014	Sheet No.	ATD-8507-1 2615 VVVVX21F136J00	Page	15-2/2