

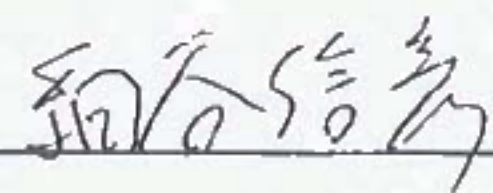
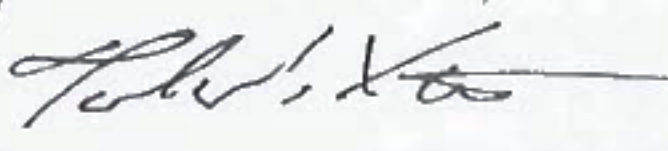
Panasonic Liquid Crystal Display Co., Ltd.**Confidential****Shenzhen JLD Electronics****For Messrs. Co., Ltd.**

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

VVX24F170H00CONTENTS

No.	Item	Sheet No.	Page
-	COVER	IPS4PS 2601 VVX24F170H00-1	1-1/1
-	RECORD OF REVISION	IPS4PS 2602 VVX24F170H00-1	2-1/1
-	DESCRIPTION	IPS4PS 2603 VVX24F170H00-1	3-1/1
1	ABSOLUTE MAXIMUM RATINGS	IPS4PS 2604 VVX24F170H00-1	4-1/2~2/2
2	INITIAL OPTICAL CHARACTERISTICS	IPS4PS 2605 VVX24F170H00-1	5-1/2~2/2
3	ELECTRICAL CHARACTERISTICS	IPS4PS 2606 VVX24F170H00-1	6-1/1
4	BLOCK DIAGRAM	IPS4PS 2607 VVX24F170H00-1	7-1/1
5	INTERFACE PIN ASSIGNMENT	IPS4PS 2608 VVX24F170H00-1	8-1/5~5/5
6	INTERFACE TIMING	IPS4PS 2609 VVX24F170H00-1	9-1/4~4/4
7	LABEL FORMAT	IPS4PS 2610 VVX24F170H00-1	10-1/2~2/2
8	COSMETIC SPECIFICATIONS	IPS4PS 2611 VVX24F170H00-1	11-1/2~2/2
9	PRECAUTION	IPS4PS 2612 VVX24F170H00-1	12-1/3~3/3
10	PACKING	IPS4PS 2613 VVX24F170H00-1	13-1/1
11	RELIABILITY TEST	IPS4PS 2614 VVX24F170H00-1	14-1/1
12	DIMENSIONAL OUTLINE	IPS4PS 2615 VVX24F170H00-1	15-1/2~2/2

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

Accepted by  Date: 2017.6.28	Panasonic Liquid Crystal Display Co., Ltd.	
	Approved by 	
	Reviewed by 	
	Proposed by H. Yuki	

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-TFT LCD module.

Product Name : VVX24F170H00

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

General specifications

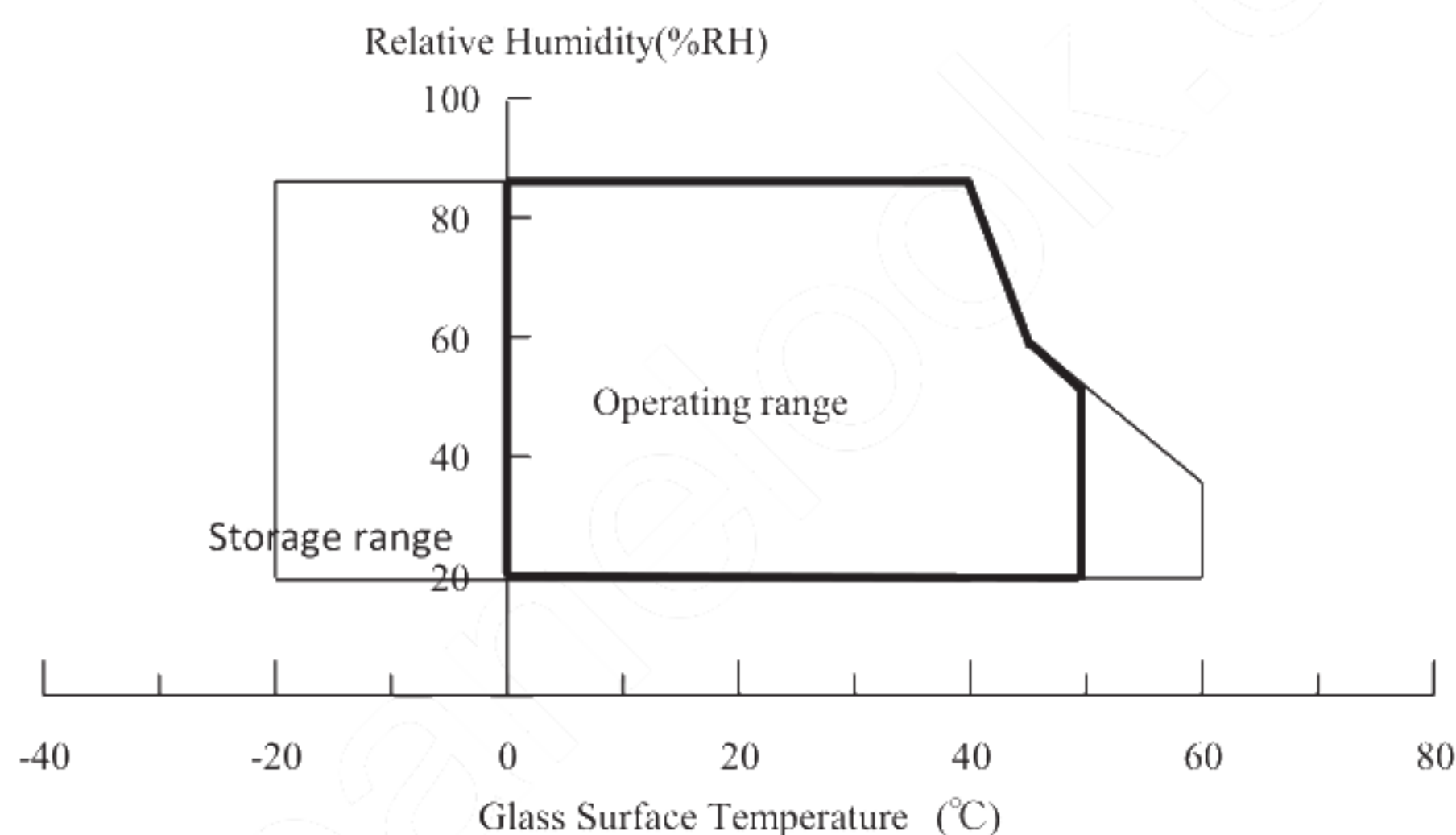
Effective display area	: (H) 518.4 × (V) 324.0	(mm)
Number of pixels	: (H) 1,920 × (V) 1,200	(pixels)
Pixel pitch	: (H) 0.270 × (V) 0.270	(mm)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Anti-Glare	
Number of colors	: 1,073,741,824(8bit + 2bit FRC)	(colors)
Viewing angle range	: Super Wide Version (Horizontal & vertical : 178° at $\phi=0^\circ, 90^\circ, 180^\circ, 270^\circ$, $CR \geq 10$)	
Input signal	: 2-channel LVDS (LVDS : Low voltage differential signaling)	
Back light	: Edge LED Type	
External dimensions	: Typ. (H) 546.4 × (V) 352.0 × (T) 16.95	(mm)
Weight	: 2.5	(kg)

1. ABSOLUTE MAXIMUM RATINGS

1.1 Environmental absolute maximum ratings

ITEM	Operating		Storage		UNIT	NOTE
	Min.	Max.	Min.	Max.		
Temperature	0	50	-20	60	°C	1),6)
Humidity	2),7)		2),7)		%RH	1)
Vibration	-	4.9(0.5 G)	-	9.8(1.0G)	m/s ²	3)
Shock	-	29.4(3 G)	-	196(20G)	m/s ²	4),5)
Corrosive gas	Not acceptable		Not acceptable		-	
Illumination at LCD Surface	-	50,000	-	50,000	lx	

- 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) $T_a \leq 40^\circ\text{C}$ Relative humidity should be less than 85 %RH max. Dew is prohibited.
 $T_a > 40^\circ\text{C}$ Relative humidity should be lower than the moisture of the 85 %RH at 40°C .
Dew is prohibited.



- 3) Frequency of the vibration is between 15 Hz and 100 Hz.(Remove the resonance point)
- 4) Direction : $\pm X$, $\pm Y$, $\pm Z$ (One time each direction)
- 5) Pulse width of the shock is 10 ms.
- 6) The temperature of LCD front surface would be 65°C in operating, it may affect the optical characteristics however it does not damage the function of the module.
- 7) The humidity of LCD front surface would be less than 20%RH in storage 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	VDD	0	13.2	V	
Input voltage for logic	V _I	-0.3	4.0	V	1)

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

(2) LED-Bar

T_a = 25 °C

ITEM	SYMBOL	Max.	UNIT	NOTE
Temperature Junction of LED	T _j	120	°C	1)
Forward Current	I _{fc}	120	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 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.

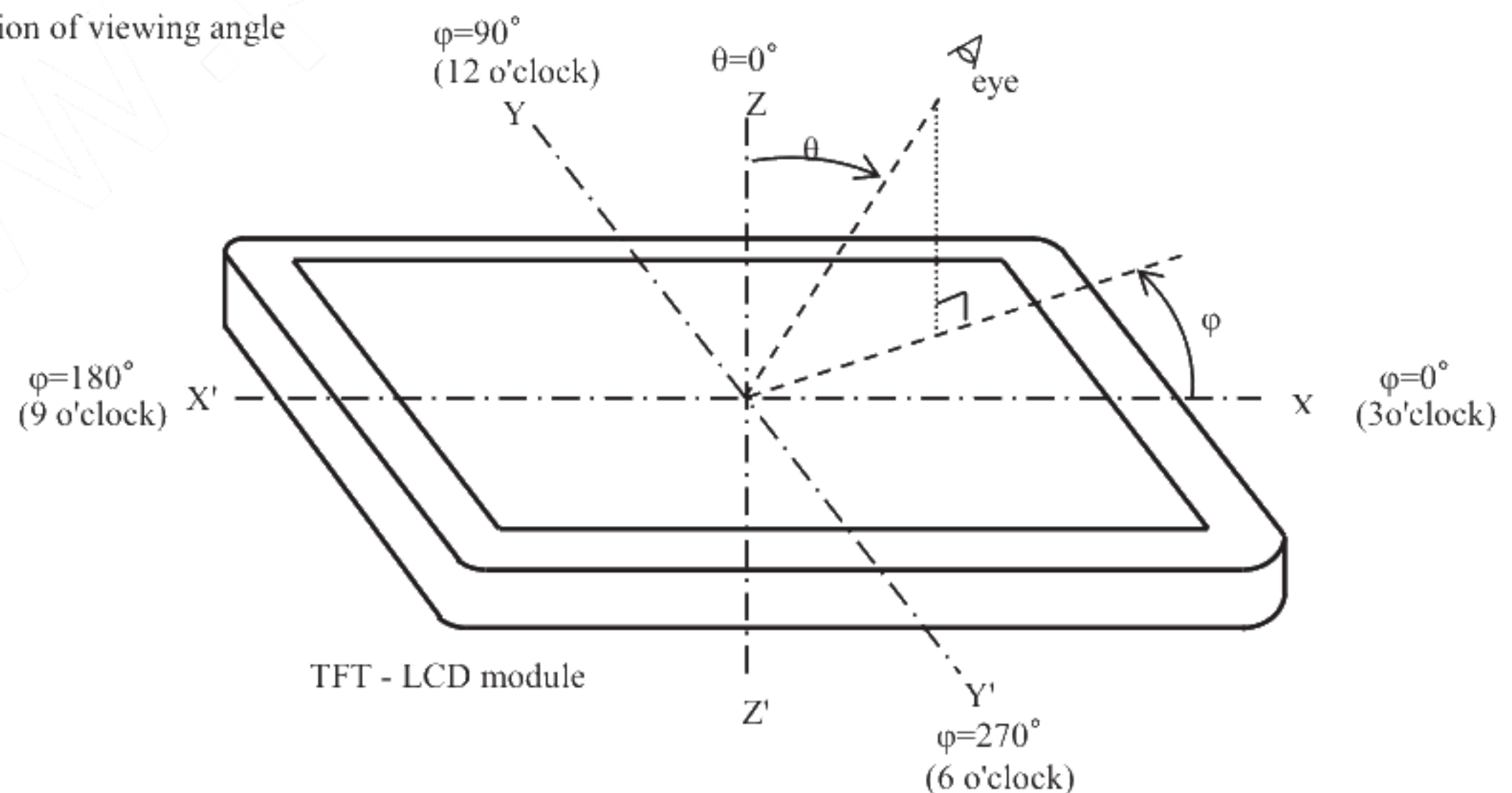
Measuring equipment : CS-2000, or equivalent

Ambient Temperature =25 °C , VDD=12.0 V , f v=60 Hz ,

Ifc=100mA

ITEM		SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE
Contrast ratio		CR	$\theta = 0^{\circ}$ 1)	1000	1500	-	-	2)
Response time	Rise	ton		-	10	20	ms	3)
	Fall	toff		-	8	20	ms	3)
Brightness of white		Bwh		560	700	-	cd/m ²	【Gray scale =1023】
Brightness uniformity		Buni		75	-	-	%	4) 【Gray scale =1023】
Color chromaticity (CIE)	Red	x		0.610	0.640	0.670	-	【Gray scale =1023】
		y		0.300	0.330	0.360		
	Green	x		0.270	0.300	0.330		
		y		0.600	0.630	0.660		
	Blue	x		0.120	0.150	0.180		
		y	0.030	0.060	0.090			
	White	x	0.283	0.313	0.343			
		y	0.299	0.329	0.359			
Variation of color position (CIE)	Red	Δx	$\theta = 50^{\circ}$ $\varphi = 0^{\circ}, 90^{\circ}, 180^{\circ}, 270^{\circ}$ 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)

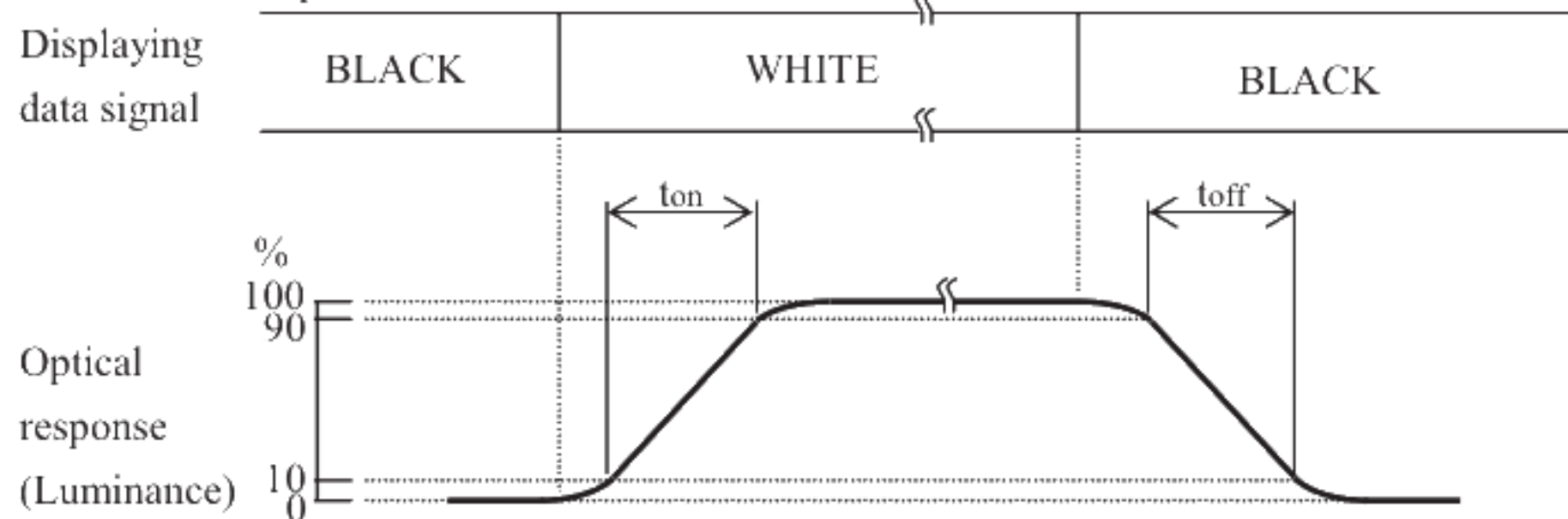
Note 1) Definition of viewing angle



Note 2) Definition of contrast ratio (CR)

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

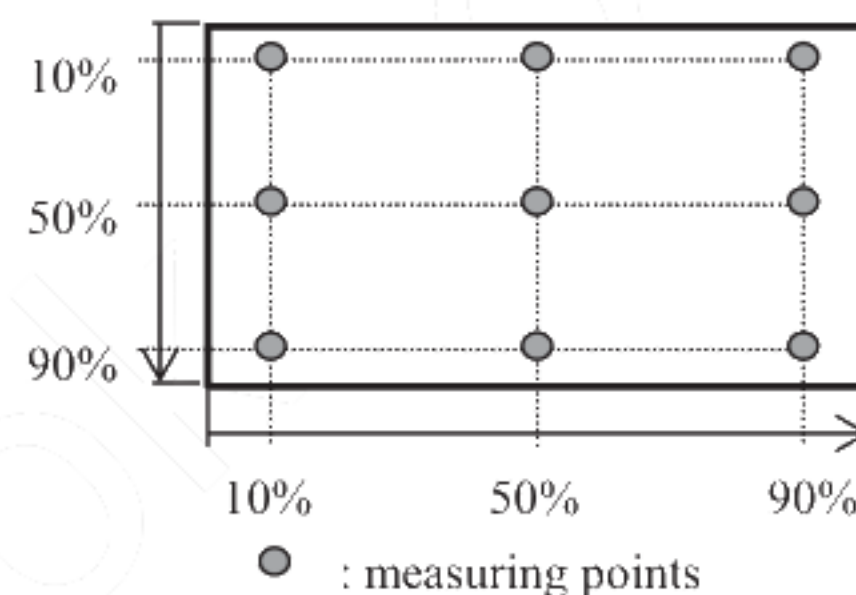
3) Definition of response time



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 color position on CIE

Variation of color position on CIE is defined as difference between colors at $\theta = 0^\circ$ and at $\theta = 50^\circ$ & $\varphi = 0^\circ$, 90° , 180° , 270° .

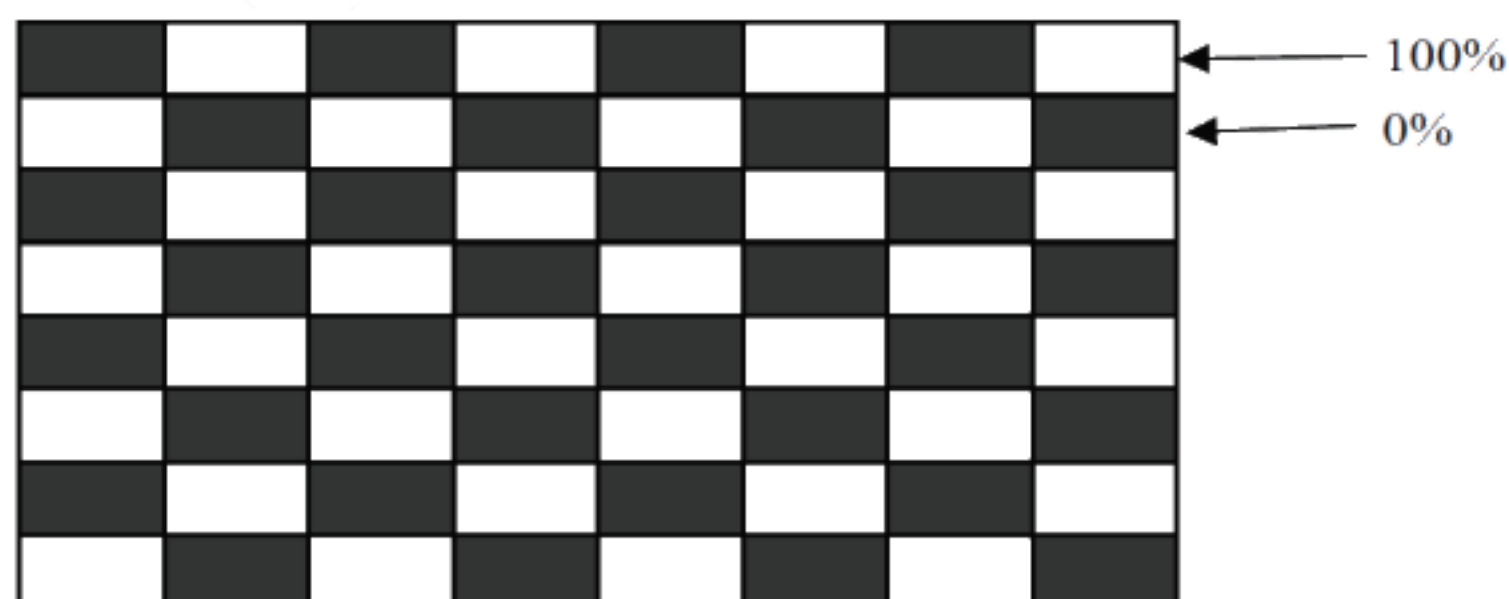
6) Contrast ratio at 89°

Evaluation conditions are on horizontal & vertical axis.

7) Image sticking

Condition : Operating mosaic pattern for 1 hours and gray (22% Gray Scale) for 0.5 hour.

Mosaic pattern



3. ELECTRICAL CHARACTERISTICS

3. 1 TFT-LCD module

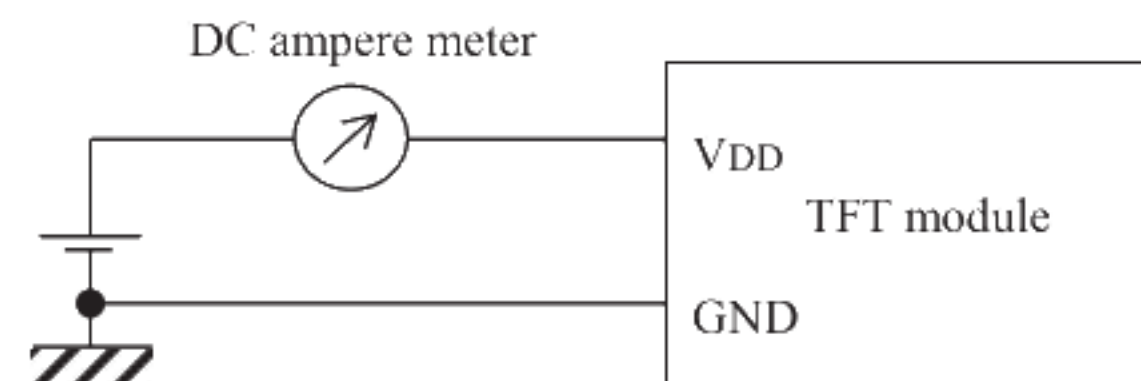
Ta = 25 °C , GND = 0 V

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage	VDD	11.4	12.0	12.6	V	
Power supply current	IDD	-	0.42	0.63	Λ	1),3)
Power supply current	IDD	-	0.56	0.84	Λ	2),3)
Ripple voltage of power supply	VDDR	-	-	150	mV	
LVDS select	High	LVDSSEL	1.7	-	2.5	V
	Low		0	-	0.6	V

Note 1) fV=60.0Hz, DCLK=77MHz, VDD=12.0V,
and display pattern is horizontal stripe.

2) fV=85.0Hz, DCLK=110MHz, VDD=12.0V,
and display pattern is horizontal stripe.

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



3. 2 Back light unit

Ta = 25 °C , GND = 0 V

ITEM		SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Forward Current (One LED Assembly)	Anode	Ifa	-	300	315	mA/connector	2 connector
	Cathode	Ifc	-	100	105	mA	
Forward Voltage	String	Vf	55.1	58.6	62.0	V	Ifc=100mA/string
	Variation	Vf(unit)	-	-	1.9	V	One LED Bar
Power Consumption		Pbl	-	35.2	39.1	W	Ifc=100mA/string
LED Life time		-	-	30,000	-	h	2)

One Backlight Unit : 1 LED-Bar (2 connector)

One connector : 3 LED String

One LED String : 10 LED package

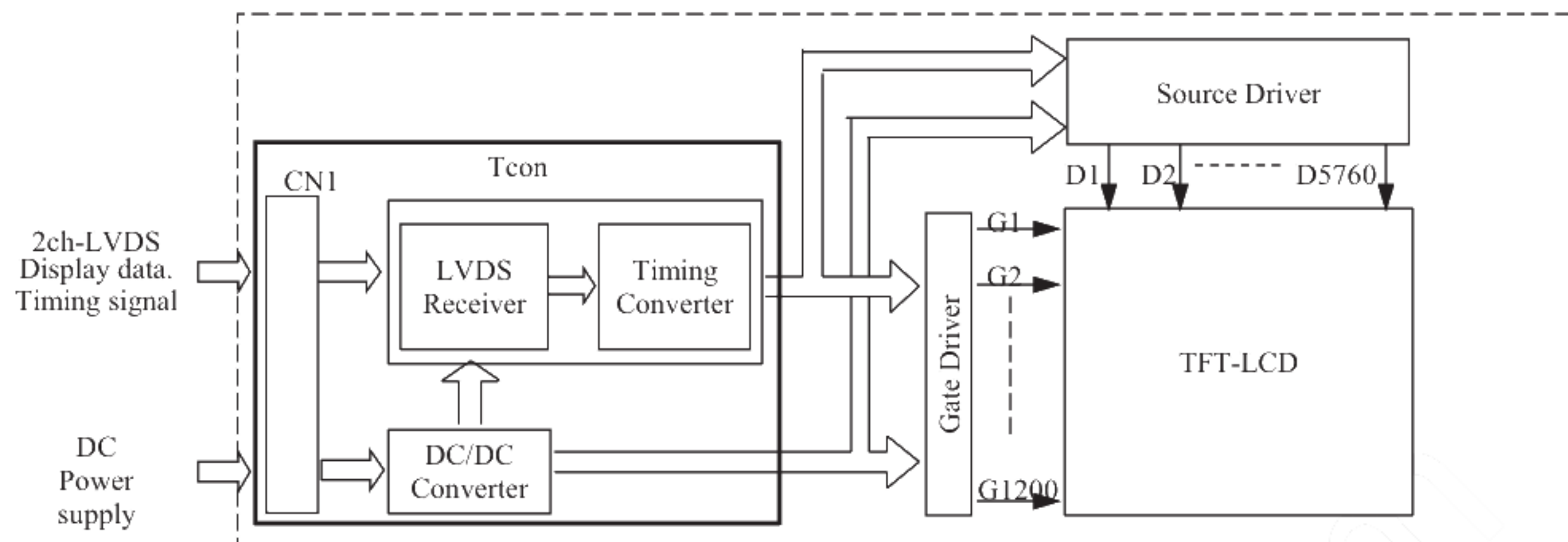
Note 1) This characteristics should be applied putting on the LED about 60 minutes later with ambient temperature.
(Ta = 25 °C ± 2 °C)

2) The life time is estimated value and not guaranteed value.

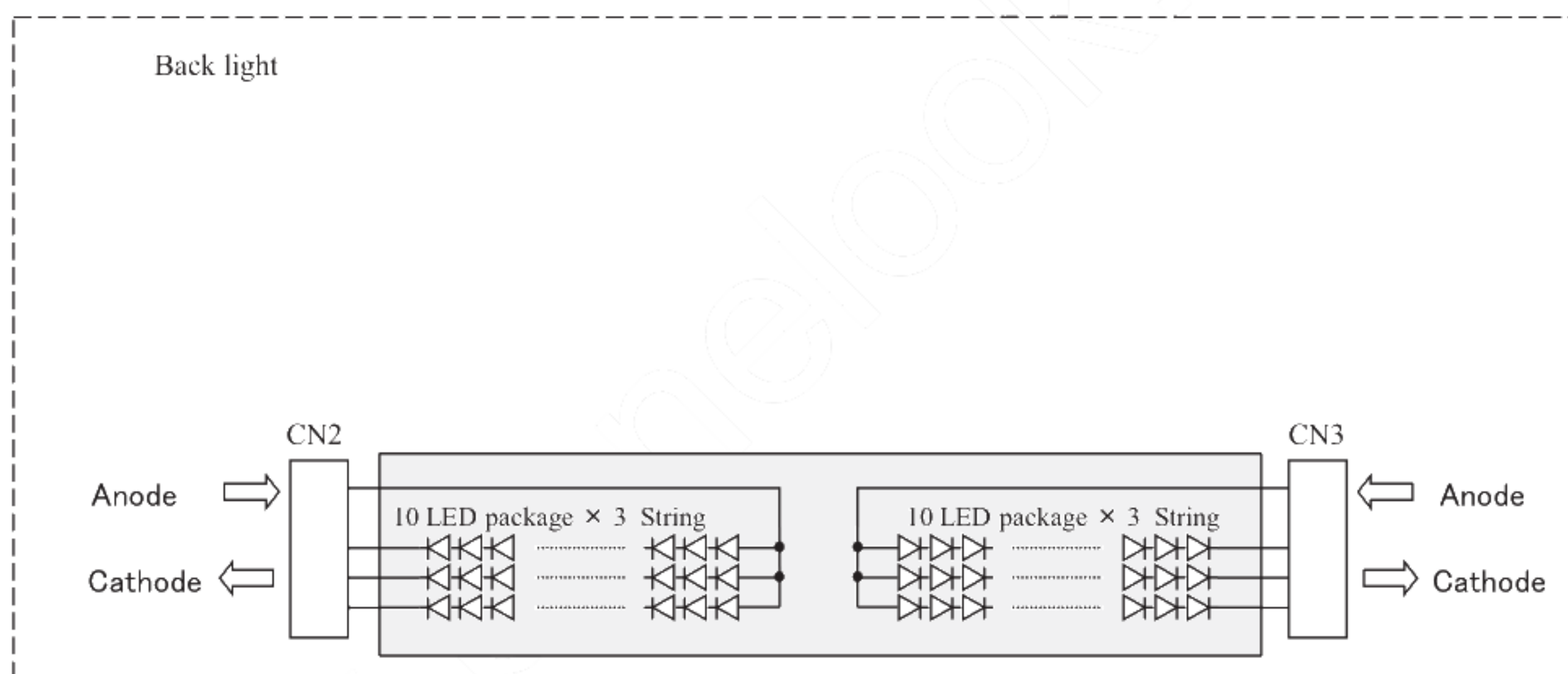
Lifetime of a LED is defined. The life is determined as the time at which brightness of the LED is 50 %
compared to that of initial value at that typical LED current on condition of continuous operating at
25 ± 2 °C.

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,FE-RE51-HL)

PIN No.	SYMBOL	DESCRIPTION	NOTE
1	GND	Ground(0V)	2)
2	IC	Internally Connected, Keep Open	
3	IC		
4	IC		
5	IC		
6	IC		
7	LVDSSEL	Select LVDS Data Format	4)
8	IC	Internally Connected, Keep Open	
9	NC	No Connection	
10	NC		
11	GND	Ground(0V)	2)
12	RxA0-	ODD Pixel Data	3)
13	RxA0+		
14	RxA1-	ODD Pixel Data	3)
15	RxA1+		
16	RxA2-	ODD Pixel Data	3)
17	RxA2+		
18	GND	Ground(0V)	2)
19	CLKA-	ODD Pixel Clock	3)
20	CLKA+		
21	GND	Ground(0V)	2)
22	RxA3-	ODD Pixel Data	3)
23	RxA3+		
24	RxA4-	ODD Pixel Data	3)
25	RxA4+		
26	GND	Ground(0V)	2)
27	GND		

PIN No.	SYMBOL	DESCRIPTION	NOTE
28	RxB0-	EVEN Pixel Data	3)
29	RxB0+		
30	RxB1-	EVEN Pixel Data	3)
31	RxB1+		
32	RxB2-	EVEN Pixel Data	3)
33	RxB2+		
34	GND	Ground(0V)	2)
35	CLKB-	EVEN Pixel Clock	3)
36	CLKB+		
37	GND	Ground(0V)	2)
38	RxB3-	EVEN Pixel Data	3)
39	RxB3+		
40	RxB4-	EVEN Pixel Data	3)
41	RxB4+		
42	GND	Ground(0V)	2)
43	GND		
44	GND		
45	GND		
46	GND		
47	NC	No Connection	
48	VLCD	Power Supply (typ.+12V)	1)
49	VLCD		
50	VLCD		
51	VLCD		

- Note
- 1) All VLCD pins shall be connected to +12.0V(Typ.).
 - 2) All GND pins shall be grounded. Metal bezel is internally connected to GND.
 - 3) Rx n+ and Rx n- (n=0,1,2,3,4) should be wired by twist-pairs or side-by-side FPC patterns, respectively.
 - 4) See page 8-3/5

5. 2 Back light unit

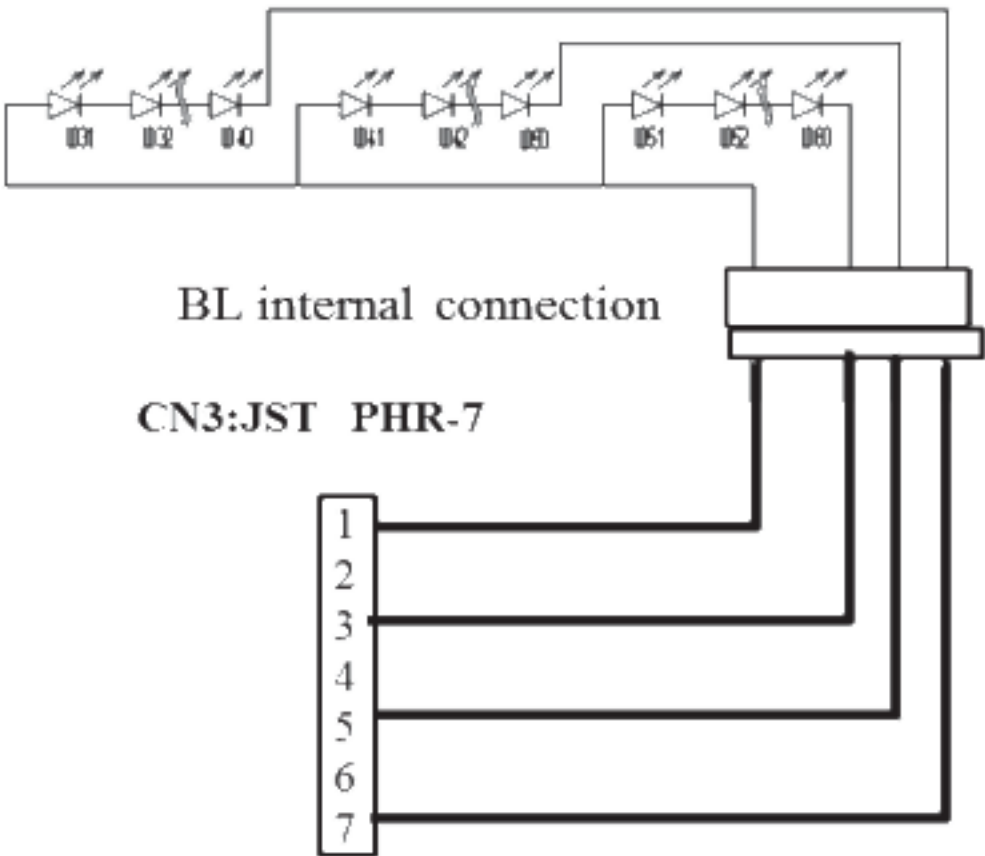
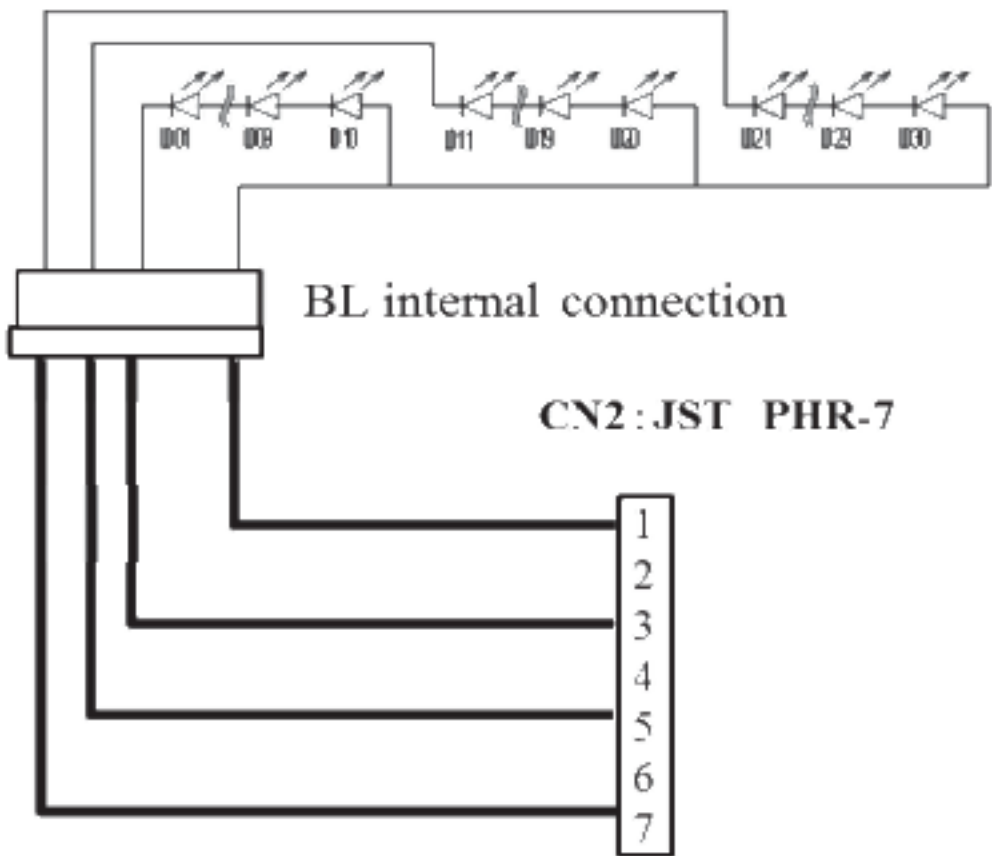
CN2:JST PHR-7

PIN No.	DESCRIPTION	NOTE
1	Anode2	
2	No connection	
3	Cathode2-1	
4	No connection	
5	Cathode2-2	
6	No connection	
7	Cathode2-3	

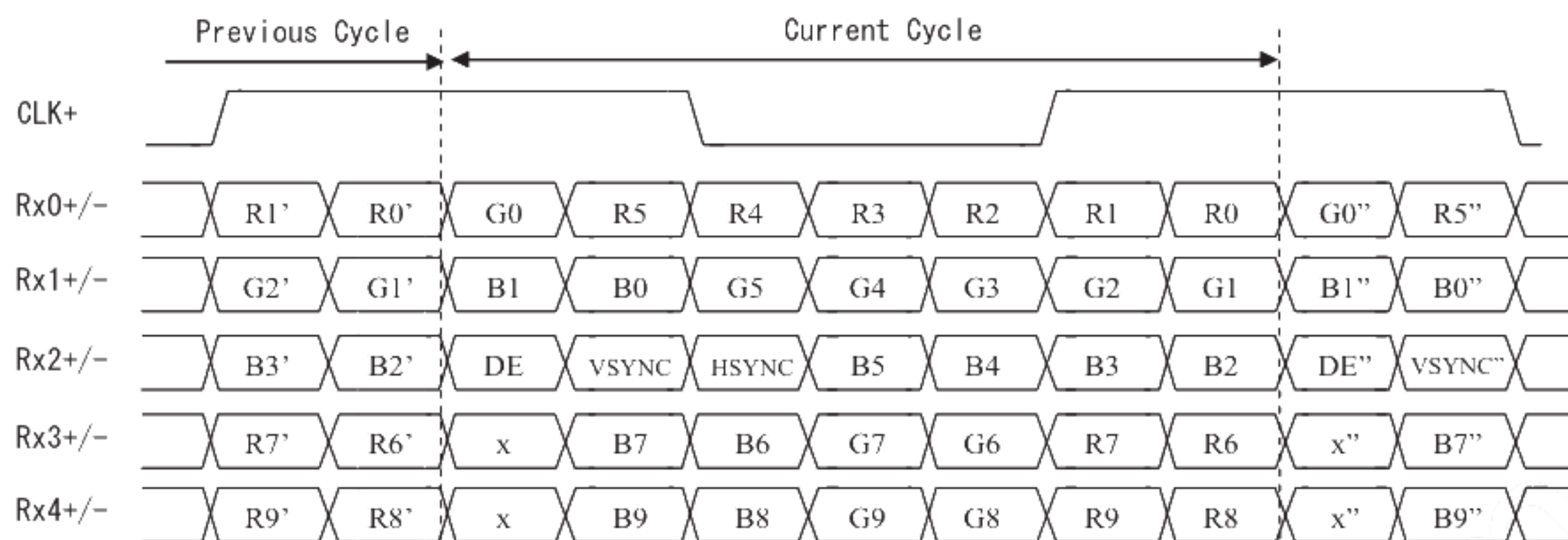
CN3:JST PHR-7

PIN No.	DESCRIPTION	NOTE
1	Anode3	
2	No connection	
3	Cathode3-1	
4	No connection	
5	Cathode3-2	
6	No connection	
7	Cathode3-3	

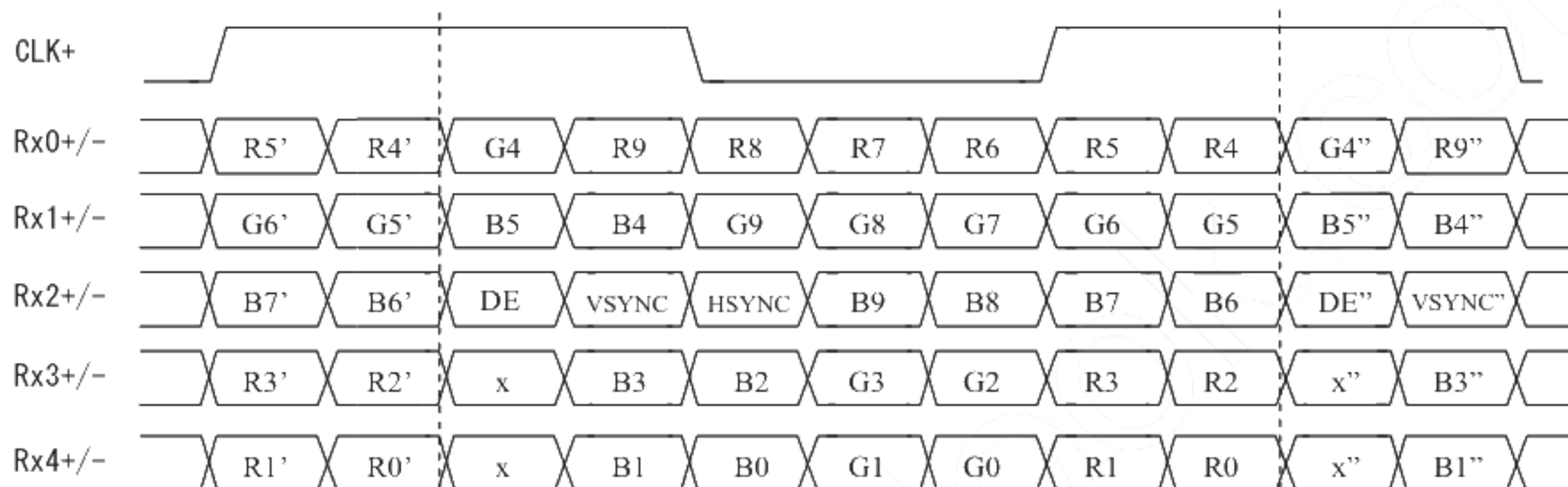
●LB internal wiring diagram



5.3 LVDS Format



VESA LVDSSEL(CN1 #7) = High or Open



JEIDA LVDSSEL(CN1 #7) = Low

DE : Data Enable

VSYNC : Vertical SYNC

HSYNC : Horizontal SYNC

x : don't care

MSB LSB

R9 --- R0 : Red Data

G9 --- G0 : Green Data

B9 --- B0 : Blue Data

5. 4 Correspondence between input data and display image

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

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

ODD pixel : RA0 - RA9 : R data

GA0 - GA9 : G data

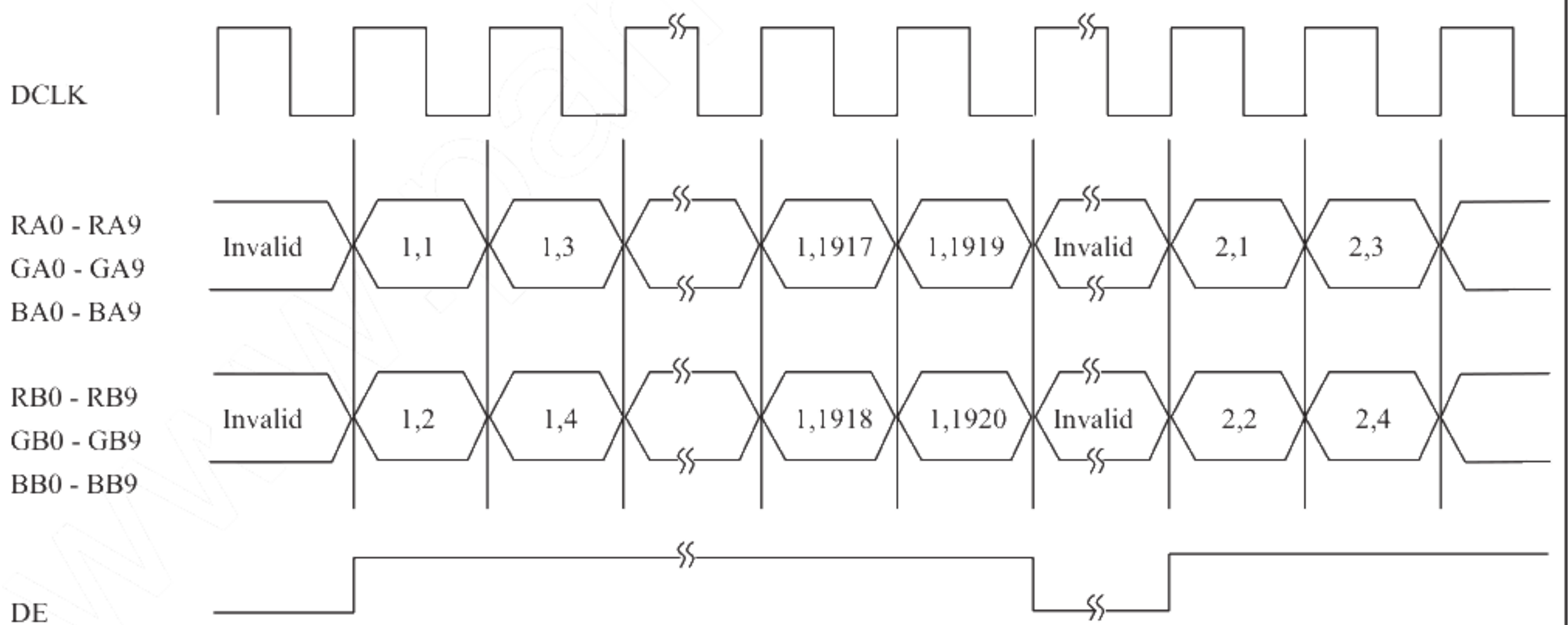
BA0 - BA9 : B data

EVEN pixel : RB0 - RB9 : R data

GB0 - GB9 : G data

BB0 - BB9 : B data

1, 1	1, 2	1, 3	-----	1, 1920
2, 1	2, 2	2, 3	-----	2, 1920
3, 1	3, 2	3, 3	-----	3, 1920
⋮	⋮	⋮		⋮
1200, 1	1200, 2	1200, 3		1200, 1920



5. 5 Relationship between display colors and input signals

Input Color		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									
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	1	0	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	1	0
	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	1	0	0
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	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.

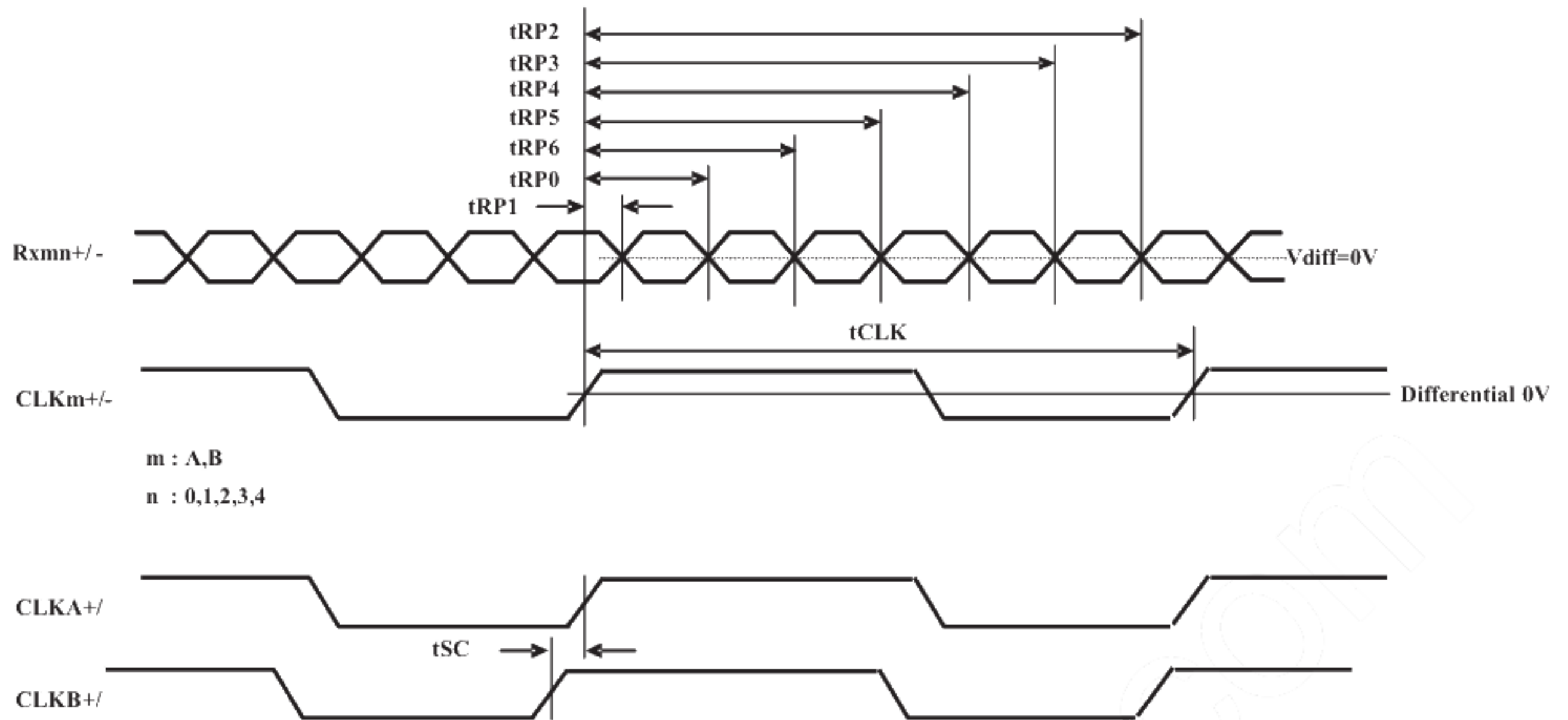
Larger n corresponds to brighter level.

2) Data : 1 : High, 0 : Low

6. INTERFACE TIMING

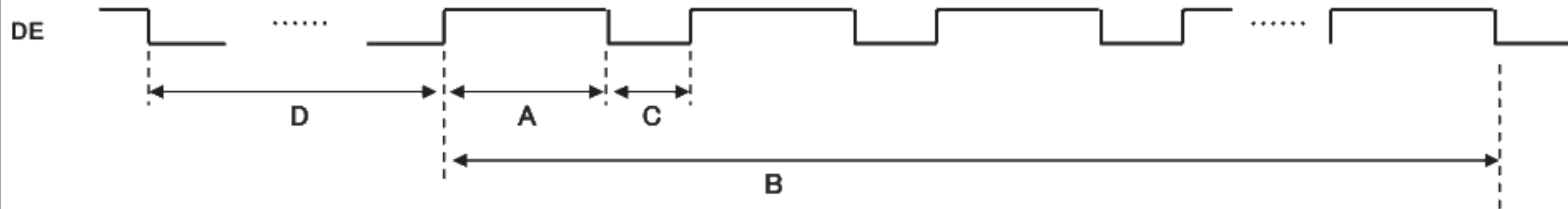
6.1 LVDS receiver timing

6.1.1 AC Characteristics



Symbol	Parameter	Min.	Typ.	Max.	Unit
t_{CLK}	CLK Period	7.69	12.99	16.67	ns
t_{RP1}	Input data Position0	-0.30	0.0	0.3	ns
t_{RP0}	Input data Position1	$t_{CLK} \cdot 1/7 - 0.3$	$t_{CLK} \cdot 1/7$	$t_{CLK} \cdot 1/7 + 0.3$	ns
t_{RP6}	Input data Position2	$t_{CLK} \cdot 2/7 - 0.3$	$t_{CLK} \cdot 2/7$	$t_{CLK} \cdot 2/7 + 0.3$	ns
t_{RP5}	Input data Position3	$t_{CLK} \cdot 3/7 - 0.3$	$t_{CLK} \cdot 3/7$	$t_{CLK} \cdot 3/7 + 0.3$	ns
t_{RP4}	Input data Position4	$t_{CLK} \cdot 4/7 - 0.3$	$t_{CLK} \cdot 4/7$	$t_{CLK} \cdot 4/7 + 0.3$	ns
t_{RP3}	Input data Position5	$t_{CLK} \cdot 5/7 - 0.3$	$t_{CLK} \cdot 5/7$	$t_{CLK} \cdot 5/7 + 0.3$	ns
t_{RP2}	Input data Position6	$t_{CLK} \cdot 6/7 - 0.3$	$t_{CLK} \cdot 6/7$	$t_{CLK} \cdot 6/7 + 0.3$	ns

6. 2 Input Signal Timing

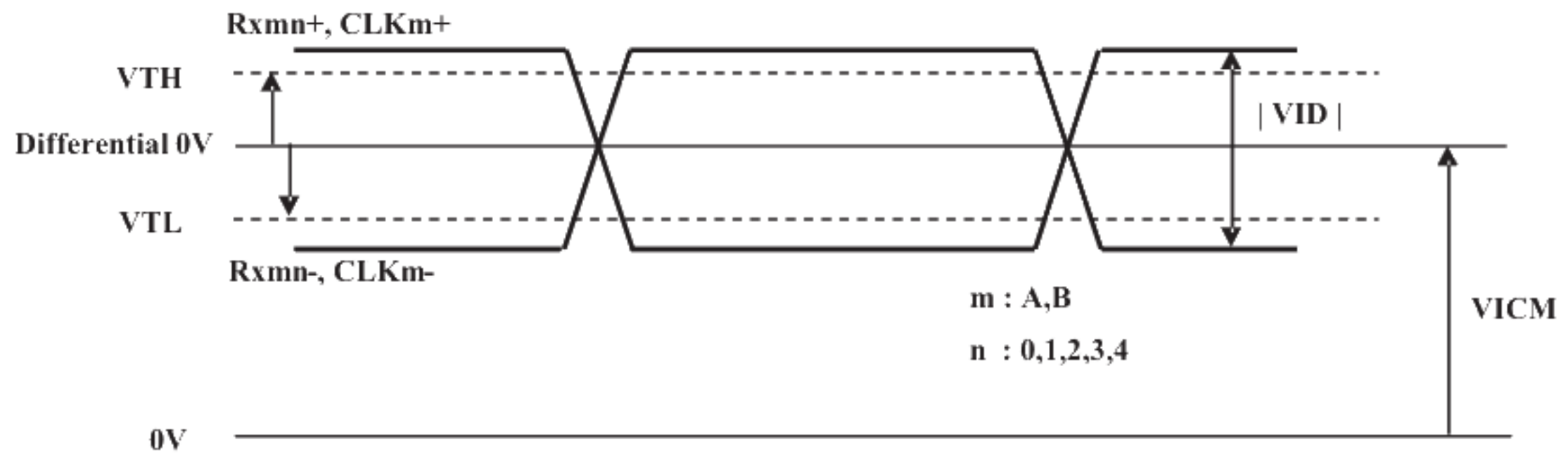


	Unit	Min.	Typ.	Max.	Note
Horizontal Active (A)	clk		960		
Vertical Active (B)	H		1200		
Horizontal Blanking (C)	clk	30	80	200	
Vertical Blanking (D)	H	10	35	500	
Pixel Clock	MHz	60	77	130	
Horizontal Frequency (A+C)	kHz	55	74.1	110	
Horizontal Frequency Jitter	clk		-	4	within a frame
Vertical Frequency (B+D)	Hz	46 *1)	60	87	

Please use it so that all ITEM matches specifications.

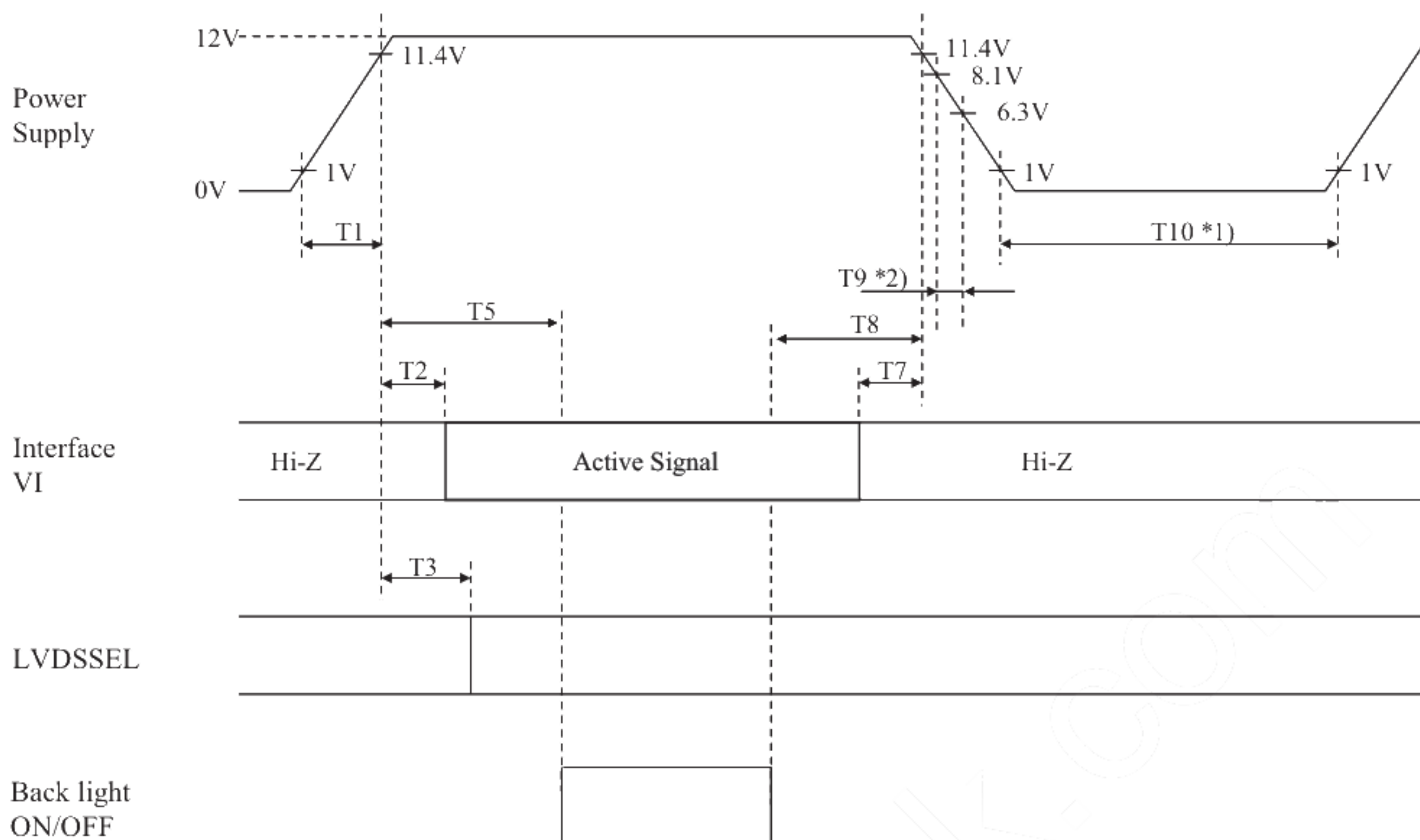
*1) Flicker is concerned. Please evaluate sufficiently.

6.3 DC Characteristics



Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{TH}	Differential Input High Threshold	$V_{ICM} = 1.2V$	-	-	100	mV
V_{TL}	Differential Input Low Threshold	$V_{ICM} = 1.2V$	-100	-	-	mV
$ VID $	Input Differential Voltage		200	400	600	mV
V_{ICM}	Differential Input Common Mode Voltage		$ VID /2$	1.2	$2.0 - VID /2$	V

6.4 Timing between interface signals power supply



SYMBOL	Min.	Typ.	Max.	UNIT
T1	2	-	10	ms
T2	30	-	-	ms
T3	0	-	T2	ms
T5	600	-	-	ms
T7	0	-	-	ms
T8	20	-	-	ms
T9	20	-	-	ms
T10	2	-	-	s

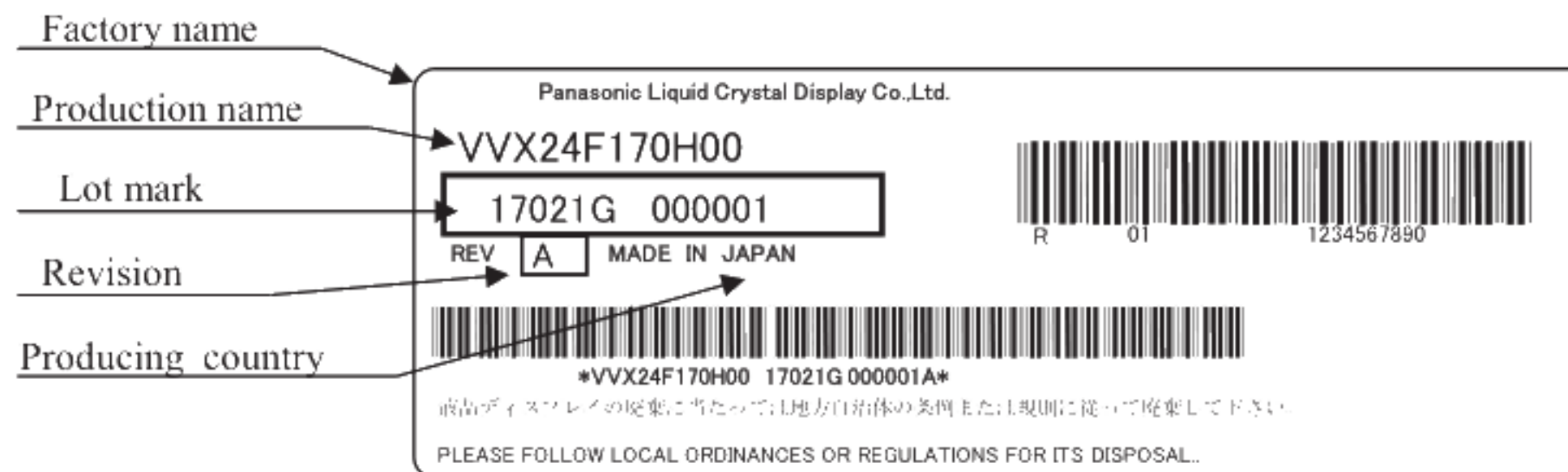
- Note
- *1) There is a case that afterimage can be seen if this specification is not followed. However, as long as the afterimage can be allowed, it is tolerated.
 - *2) The T9 is recommended value. If T9 is shorter than the minimum specification, abnormal display might be shown. However, there is no malfunction.

7. LABEL FORMAT

7.1 Label

The module label is on the metallic bezel as shown in 12.2 Outline Drawing (Back Side).

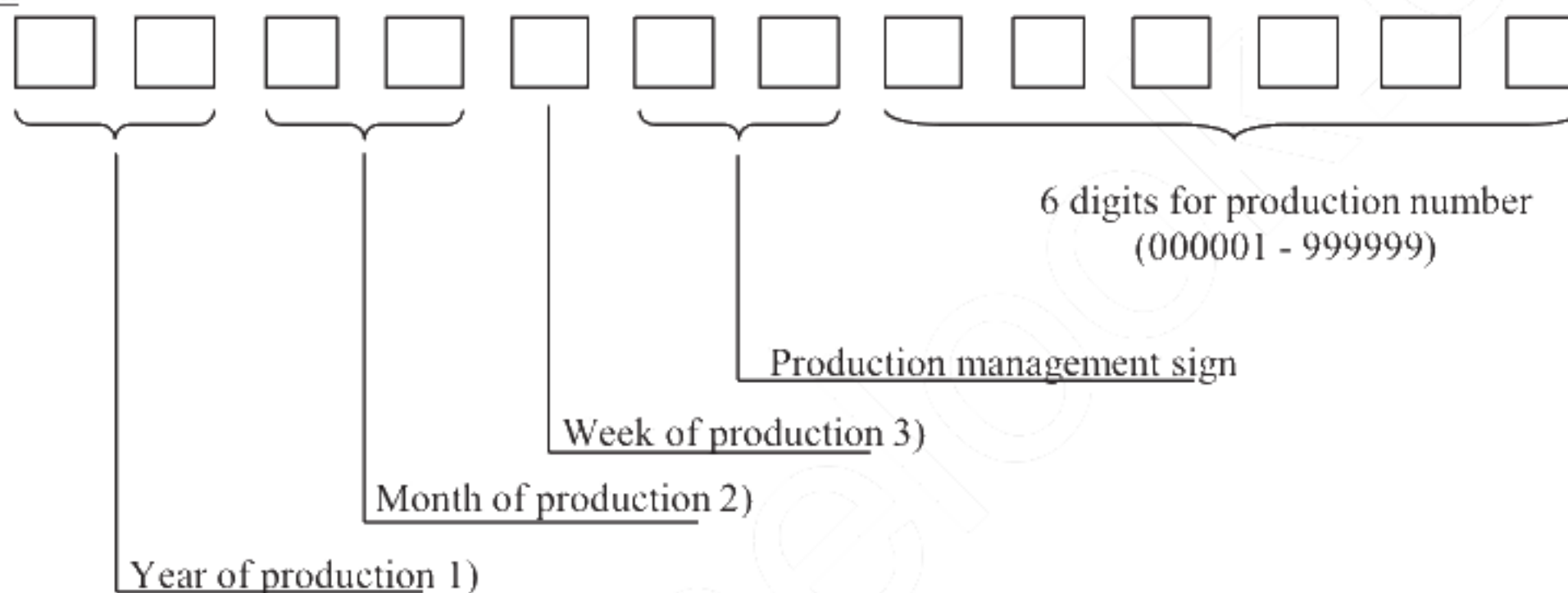
The style of character will be changed without notice.



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
17	2017
18	2018
19	2019

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

Rev.A=Initial

Panasonic Liquid Crystal Display Co., Ltd.	Date	Jun.22,2017	Sheet No.	IPS4PS 2610 VVX24F170H00-1	Page	10-2/2
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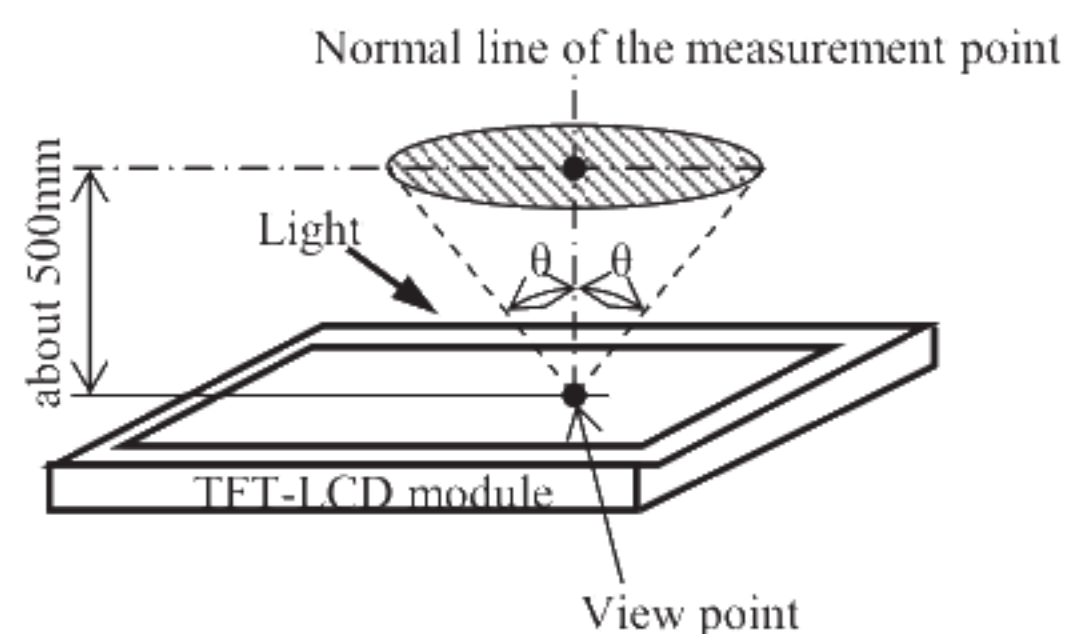
8. COSMETIC SPECIFICATIONS

8.1 Condition for cosmetic inspection

(1) Viewing zone

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

Inspection view

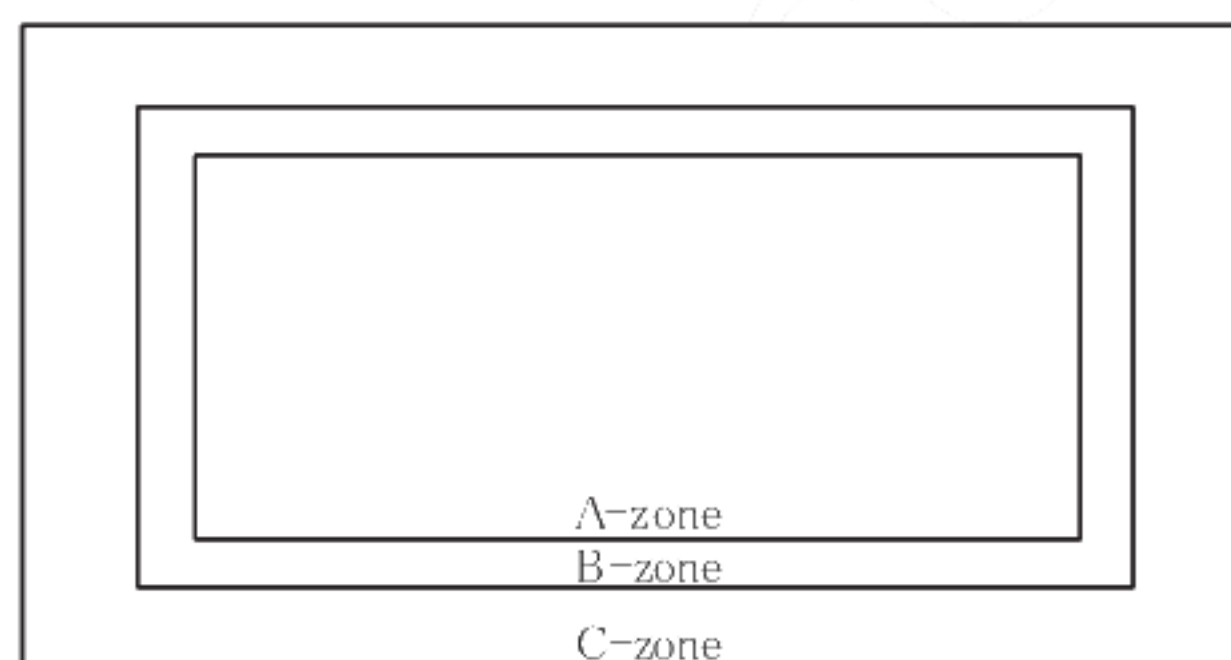


(2) Environmental

- Temperature : 25 degrees
- Ambient light : about 100 lx and non-directive when operating inspection.
 : about 1000 lx and non-directive when non-operating inspection.
- 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.

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	14	pcs	1),3)	
				2-dots	0		Units	1),4),5)	
				3-dots	0				
				Density	3		pcs/φ20mm	1),6)	
				Total	14		pcs	1)	
			Black mode	1-dot	8		pcs	2),3)	
				2-dots	1		Units	2),4),5),7)	
				3-dots	0				
				Density	3		pcs/φ20mm	2),6)	
				Total	8		pcs	2)	
	2	Uneven brightness	Kumi mura			The brightness of Kumi mura is under 300% of the brightness of Center within Black Screen.		-	-
			Others			Serious one is not allowed. 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)	$W \leq 0.01$	$L < 0.3$	Ignore	pcs
			$W \leq 0.1$	$L \leq 5.0$	3	
				$L > 5.0$	0	
			$W > 0.1$	-	0	
	4	Stain inclusion Dot shape [D : ave. dia (mm)]	$D \leq 0.22$		Ignore	pcs
			$D \leq 0.5$		8	
			$D > 0.5$		0	
	5	Scratch on polarizer Line shape [W : width (mm)] L : length (mm)	$W \leq 0.02$	L : Ignore	Ignore	pcs
			$W \leq 0.08$	$L \leq 20$	3	
				$L > 20$	0	
			$W > 0.08$	-	0	
	6	Scratch on polarizer Dot shape [D : ave. dia (mm)]	$D \leq 0.2$		Ignore	pcs
			$D \leq 0.6$		10	
			$D > 0.6$		0	
Non operating inspection	7	Bubbles, peeling in polarizer [D : ave. dia (mm)]	$D \leq 0.2$		Ignore	pcs
			$D \leq 0.5$		10	
			$D > 0.5$		0	
	8	Wrinkles on polarizer		Serious one is not allowed.		-

Note 1) Sparkle mode is judged on black raster.

Bright defect $G \geq 384$ (check comparing with 384/1023 tone green dot)

$R \geq 512$ (check comparing with 512/1023 tone red dot)

$B \geq 512$ (check comparing with 512/1023 tone blue dot)

Low bright defect $384 > G \geq 100$ (check comparing with 384/1023 tone and 100/1023 tone green dot)

$512 > R \geq 100$ (check comparing with 512/1023 tone and 100/1023 tone red dot)

$512 > B \geq 196$ (check comparing with 512/1023 tone and 196/1023 tone blue dot)

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-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..

5) Definition of 2-Dots defects

This is the case that there is a defect in any places marked『△』toward『×』.

R	G	B	R	G	B	R	G	B
			△	△	△			
R	G	B	R	△	B	R	G	B
			△	×	△			
R	G	B	R	G	B	R	G	B
			△	△	△			

6) Density : number of defect dots inside $\phi 20\text{mm}$

7) 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.

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

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

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

9. PRECAUTION

Please pay attention to the followings when a TFT module with a back-light 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.

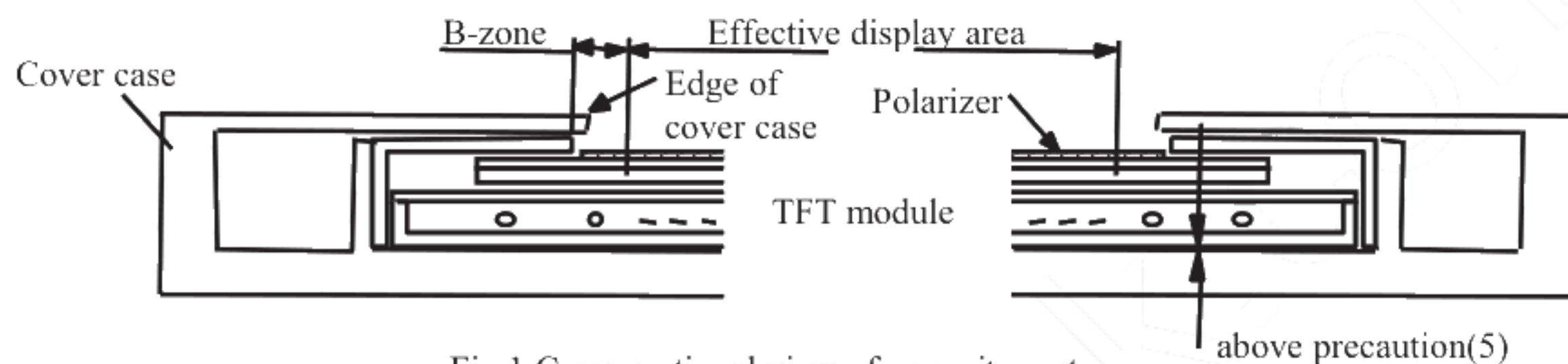


Fig.1 Cross sectional view of a monitor set

- (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 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, toluene 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 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) Lifetime and failure rate depends on environment parameters such as temperature or humidity, etc., even if the parameters are in spec.
- (5) Sudden temperature change may cause dew on and/or in the a module. Dew causes damage to a polarizer and/or electrical contacting portion. Dew causes fading of displayed quality.
- (6) Fixed patterns displayed on a module for a long time may cause after-image. It will be recovered soon.
- (7) 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.
- (8) Noise may be heard when a back-light is operated. If necessary, sufficient suppression should be done by system manufacturers.
- (9) The module should not be connected or removed while a main system works.
- (10) Inserting or pulling I/F connectors causes any trouble when power supply and signal dates are on-state. I/F connectors should be inserted and pulled after power supply and signal dates 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°C 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.

Panasonic Liquid Crystal Display Co., Ltd.	Date	Jun.22,2017	Sheet No.	IPS4PS 2612 VVX24F170H00-1	Page	12-2/3
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9.6 Precaution to handling protection film

- (1) The protection film for polarizers should be peeled 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

- (1) 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.

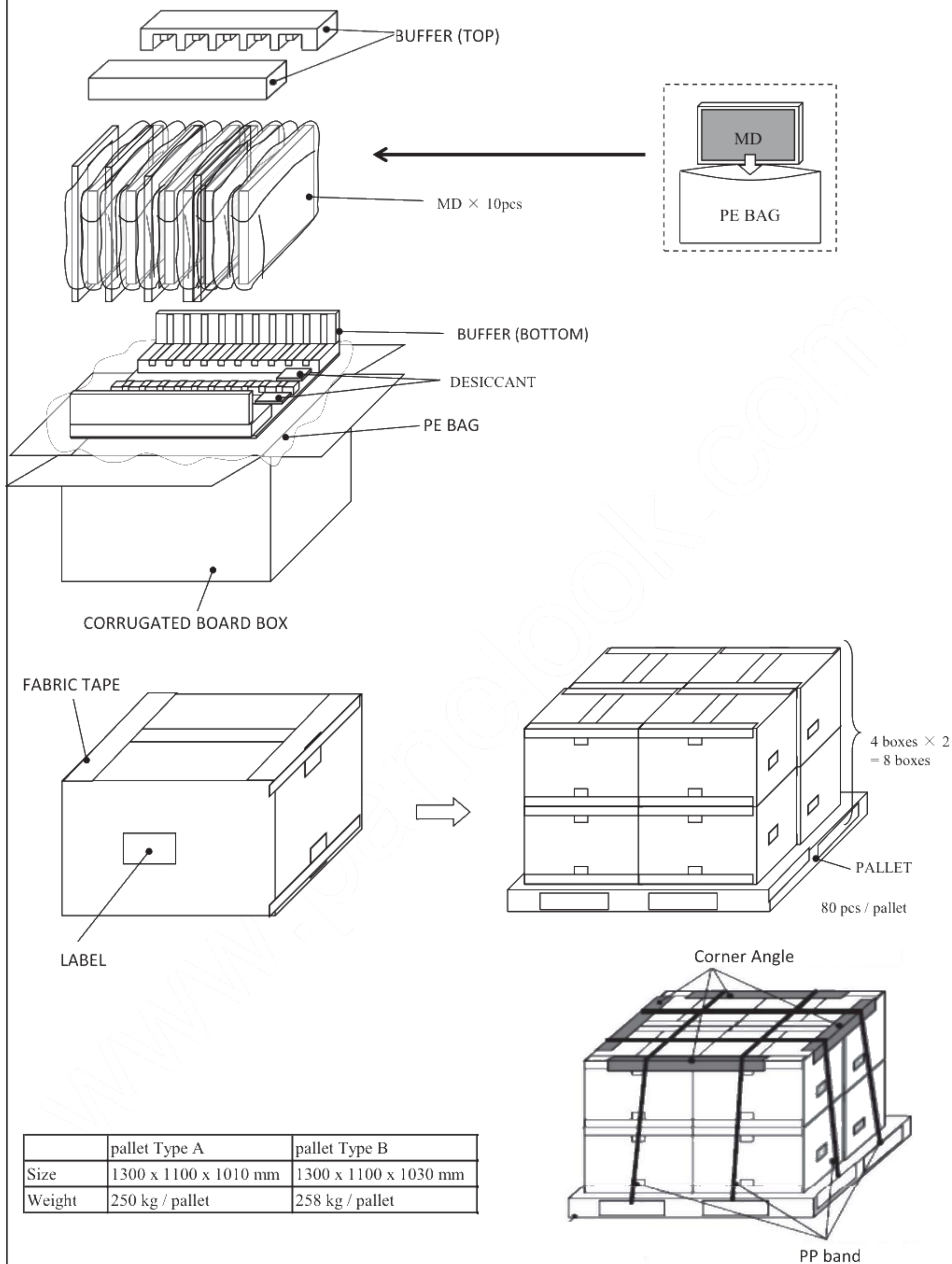
9.10 Use restrictions and limitations

- (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 contract, breach of warranty, negligence, strict liability, misrepresentation and other torts.

9.11 Others

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

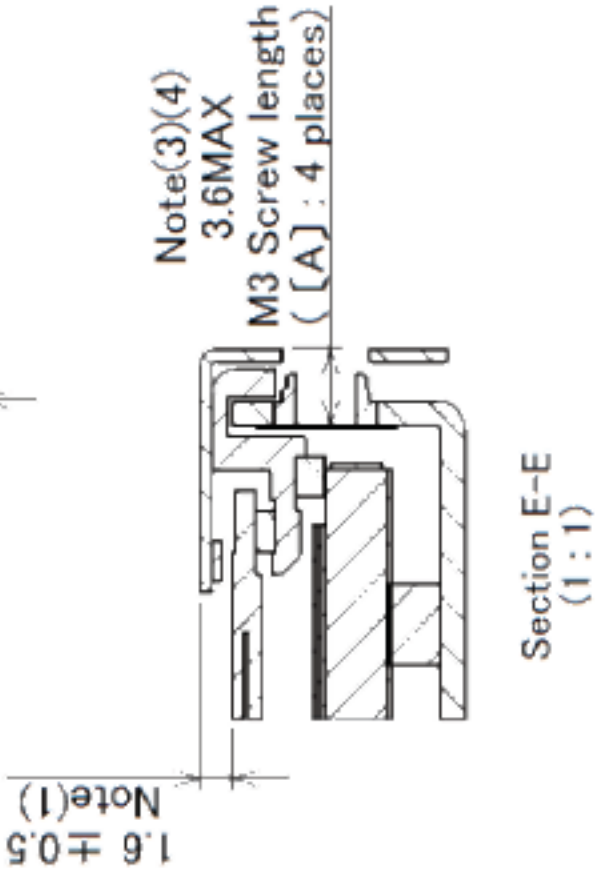
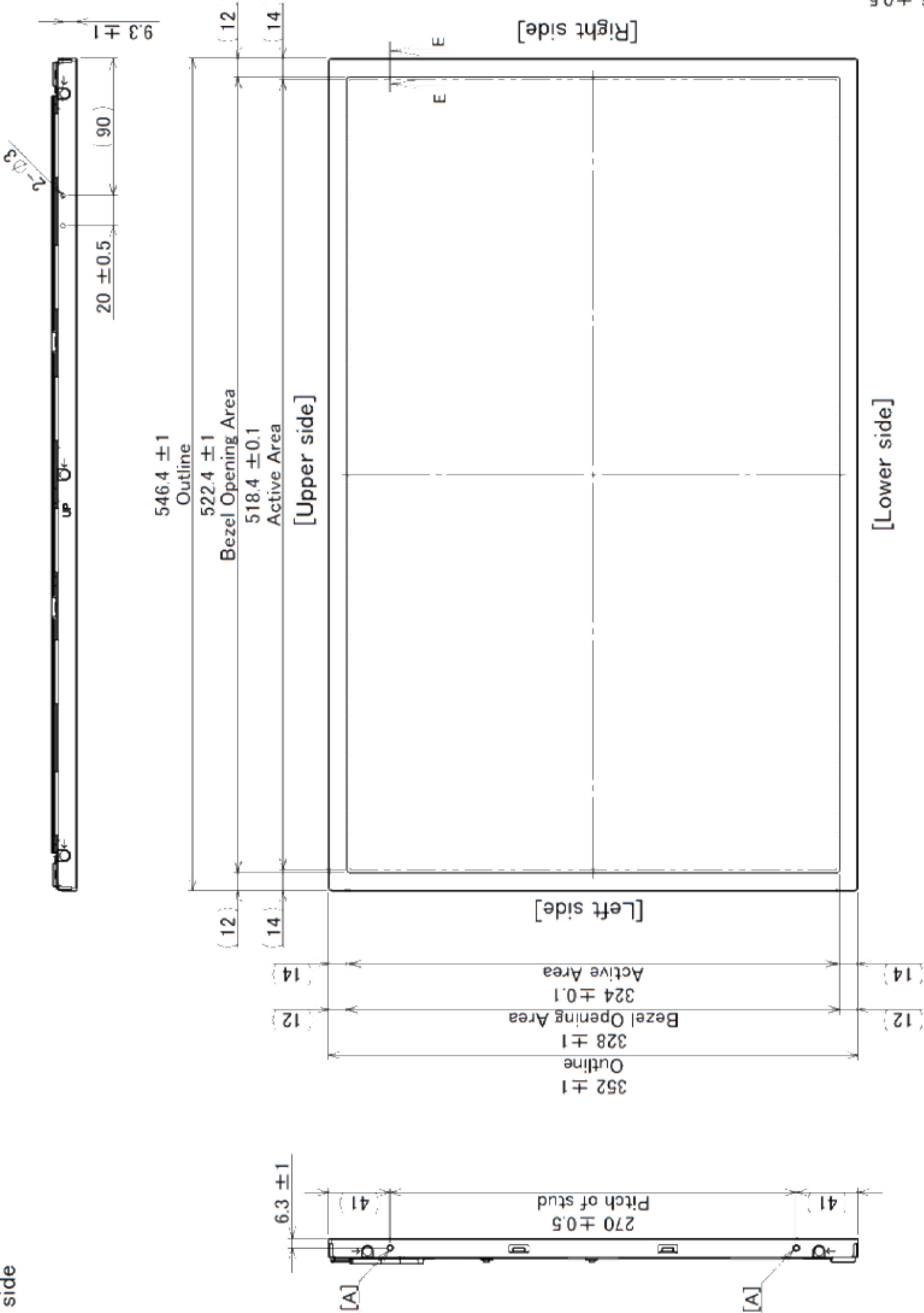
10.Packing



11. Reliability test

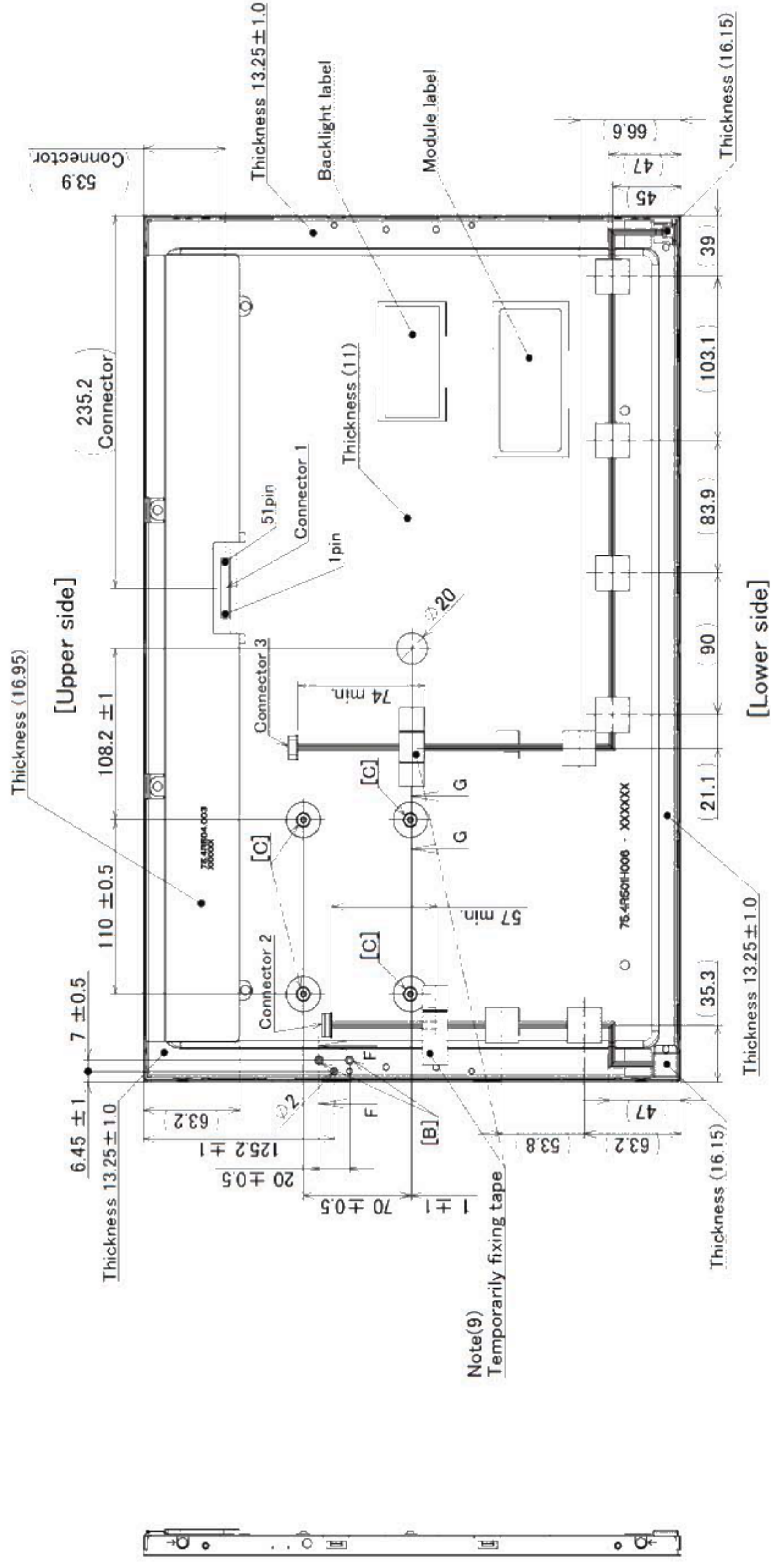
No.	Item		condition	Period	Criteria for judgment
1	Low Temperature / Operating		Ta=0°C	500h	No malfunction
2	High Temperature / Operating		Ta=45°C	500h	
3	Low Temperature / Storage		Ta=-20°C	240h	
4	High Temperature / Storage		Ta=70°C	240h	
5	High Temperature High Humidity / Storage		40°C 80%RH	240h	
6	Heat shock		-25/70°C 30min./30min.	100cy	
7	Heat shock test for solder		-35/85°C 30min./30min.	200cy	
8	ESD	The surface of a metallic bezel and a LCD panel	C = 150 pF, R = 330 ohm Environment : 15-35°C/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°C/30-60%RH V input : +/- 100V Contact discharge control signals.		No destruction

1. Front side



Note (1)The measuring method depends on Panasonic Liquid Crystal Display CO.,LTD standard.
(2)For portrait use, please use the right side to be lower.
(3)M3 screws to be used for the [A] part, please use the 3.6mm or less from the module outline.
There is a risk that the module is broken when use longer than that.
(4)[A]The customer mount M3 : Torque MAX. 0.6N•m(6.12kgf•cm)

Unit:mm



Note(7)(8)
4.5 MAX

M3 Screw length
4.5 MAX
[C] : 4 places)

Note(6)(8)
2.4 MAX
M3 Screw length
([B] : 2 places)

Section F-F

Section G-G

Note (5) Thickness is the distance from the bezel front surface.

(6) M3 screws to be used for the [B] part, please use the 2.4mm or less from the module outline. There is a risk that the module is broken when use longer than that.

(7) M3 screws to be used for the [C] part, please use the 4.5mm or less from the top of these.

(8) [B] [C] The customer mount M3 · Torque MAX. 0.6N · m(6.12kgf · cm)

(9) Do not peel off the tapes except temporarily fixed.

Unit:mm