

Tentative

# Panasonic Liquid Crystal Display Co.,Ltd.

## TECHNICAL DATA

### VVX21F136J00

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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

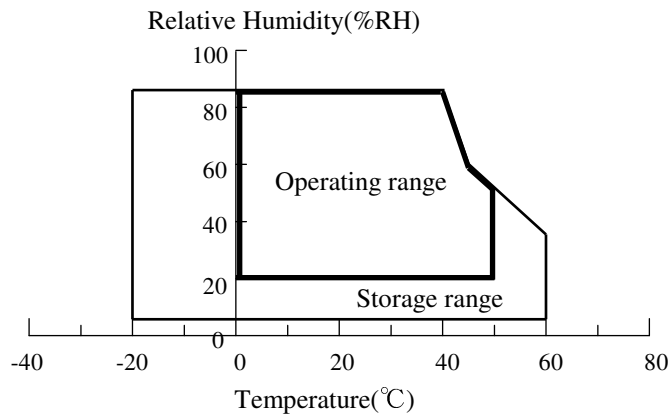
Effective display area	: (H) 432 × (V) 324	(mm)
Number of pixels	: (H) 1,600 × (V) 1,200	(pixels)
Pixel pitch	: (H) 0.270 × (V) 0.270	(mm)
Color pixel arrangement	: R+G+B vertical stripe	
Display mode	: Transmissive mode Normally black mode	
Top polarizer type	: Anti-Glare	
Number of colors	: 16,777,216	(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. (2,800)	(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	°C	1),5),6)
Humidity	2)		2)		%RH	1)
Vibration	-	4.9(0.5 G)	-	14.7(1.5 G)	m/s <sup>2</sup>	3)
Shock	-	29.4(3 G)	-	294(30 G)	m/s <sup>2</sup>	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)  $T_a \leq 40^\circ\text{C}$  ..... 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.



- 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 °C 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	V <sub>ESD0</sub>	±100		V	2),3)
	V <sub>ESD1</sub>	±8		kV	2),4)

- Note
- 1) It is applied to pixel data signal, clock signal and other control signals.
  - 2) Discharge Coefficient : 250 pF - 100 Ω, Environmental : 25 °C - 70%RH
  - 3) It is applied to I/F connector pins.
  - 4) It is applied to the surface of a metallic bezel and a LCD panel.

(2) Backlight unit

ITEM	SYMBOL	Max.	UNIT	NOTE
Temperature Junction of LED	T <sub>j</sub>	120	°C	1)
Forward Current	I <sub>f</sub>	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.

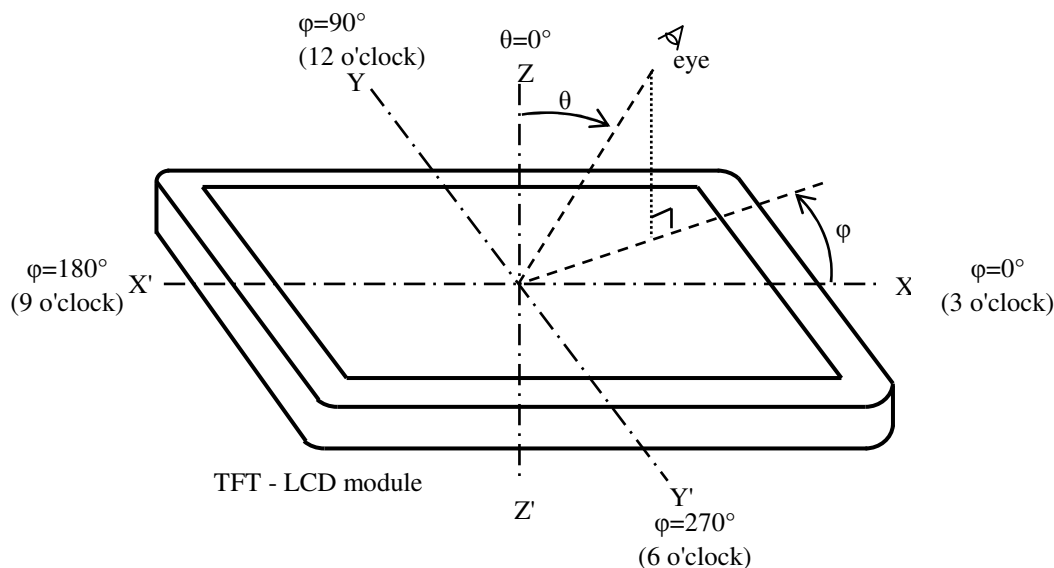
Measuring equipment : CS-1000A, or equivalent

Ambient Temperature =25 °C , f v=60 Hz ,

Ifc = 60mA/string

ITEM	SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT	NOTE	
Contrast ratio	CR	$\theta = 0^\circ$ 1)	(800)	(1400)	-	-	2)	
Response time	Rise		ton	-	(11)	(20)	ms	3)
	Fall		toff	-	(9)	(20)	ms	3)
Brightness of white	Bwh			(340)	(440)	-	cd/m <sup>2</sup>	
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	$\Delta x$	-	-	0.04	-	5) 【Gray scale =255】	
		$\Delta y$	-	-	0.04			
	Green	$\Delta x$	-	-	0.04			
		$\Delta y$	-	-	0.04			
	Blue	$\Delta x$	-	-	0.04			
		$\Delta y$	-	-	0.04			
	White	$\Delta x$	-	-	0.04			
		$\Delta y$	-	-	0.04			
Contrast ratio at 89 °	CR89	$\varphi=0^\circ, 90^\circ, 180^\circ, 270^\circ$ 6)	10	-	-	-	Estimated value	
Image sticking	-	Mosaic pattern	Invisible			-	7)	

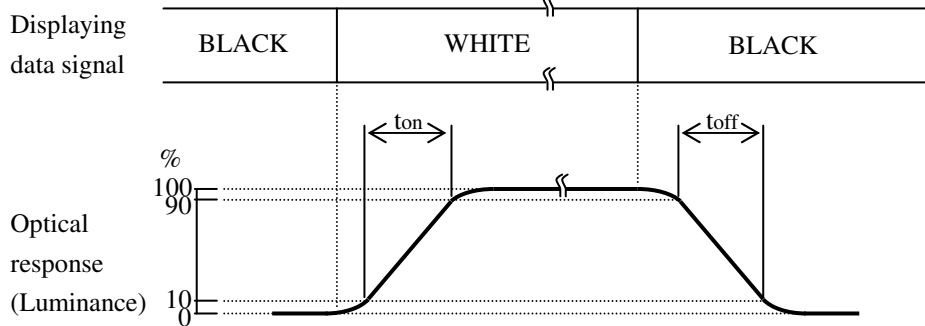
Note 1) Definition of viewing angle



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

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.

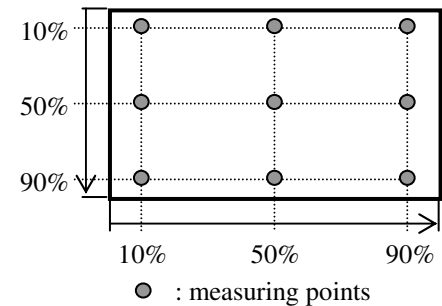
$$B_{uni} = \frac{|B_{max} \text{ or } B_{min} - B_{ave}|}{B_{ave}} \times 100$$

where,  $B_{max}$  = Maximum brightness

$B_{min}$  = Minimum brightness

$B_{ave}$  = Average brightness

$$B_{ave} = \frac{\sum_{k=1}^9 (B(k))}{9}$$



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  $\theta = 50^\circ$  &  $\varphi = 0^\circ, 90^\circ, 180^\circ, 270^\circ$ .

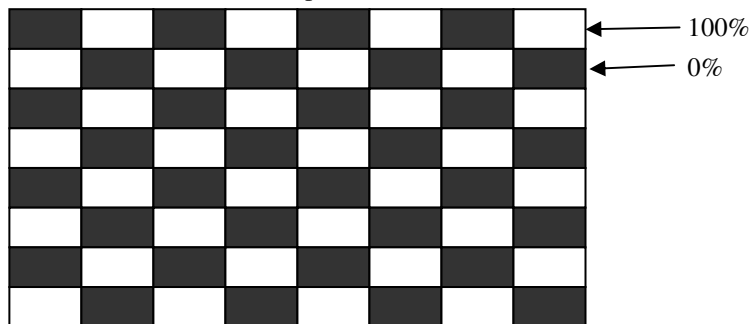
6) Contrast ratio at  $89^\circ$

Evaluation conditions are on horizontal & vertical axis

7) Image sticking

Condition : Operating mosaic pattern for 2 hours and gray scale ( 22 % ) for 1 hour.

Mosaic pattern



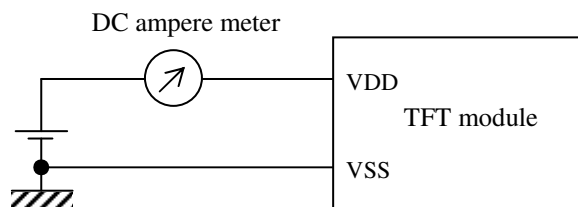
### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT-LCD module

Ta = 25 °C , GND = 0 V

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT	NOTE
Power supply voltage	VDD	4.5	5.0	5.5	V	
Power supply current	IDD	-	(0.7)	(1.0)	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 °C , Vss = 0 V

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT	NOTE	
Forward Current (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.

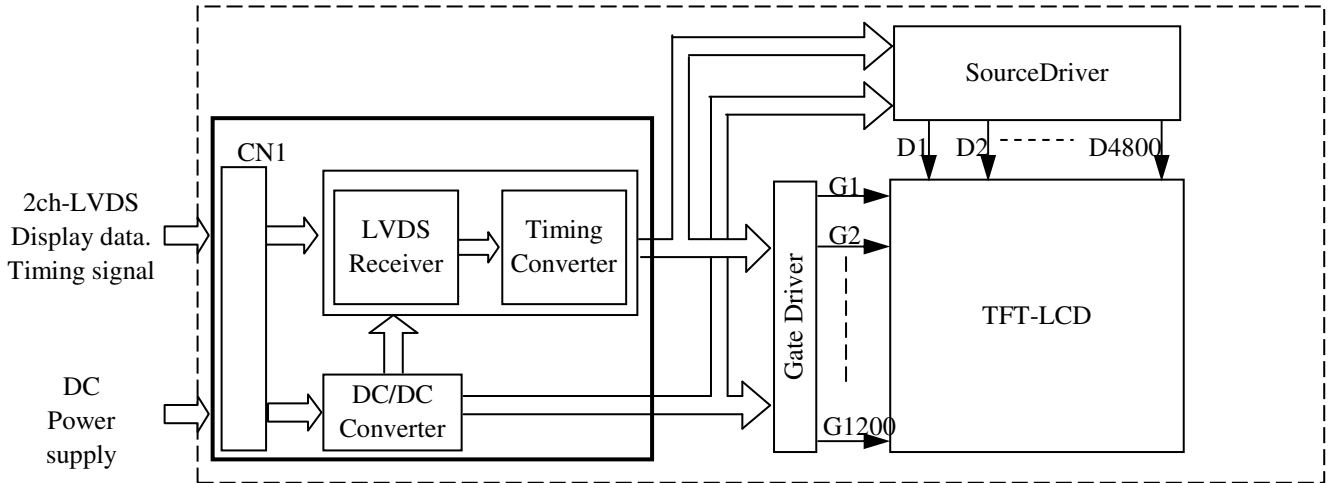
One LED String : 11 LED package.

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

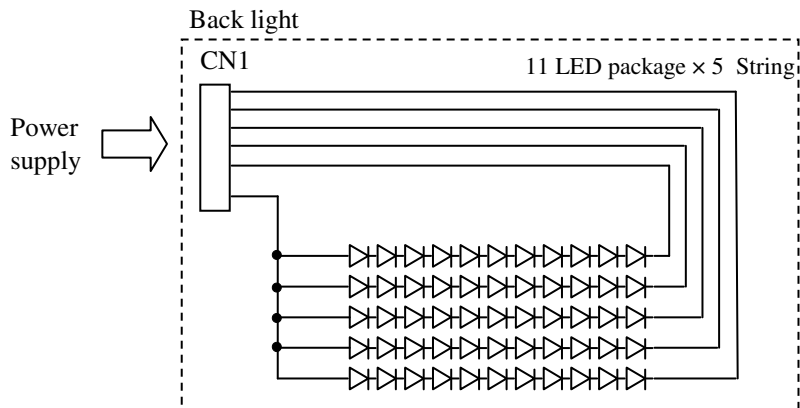


## 4. BLOCK DIAGRAM

### 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	1)
2	RxA0+	Odd Pixel Data	
3	RxA1-	LVDS	1)
4	RxA1+	Odd Pixel Data	
5	RxA2-	LVDS	1)
6	RxA2+	Odd Pixel Data	
7	GND	Ground(0V)	2)
8	RxAC-	LVDS	1)
9	RxAC+	Odd Pixel Clock	
10	RxA3-	LVDS	1)
11	RxA3+	Odd Pixel Data	
12	RxB0-	LVDS	1)
13	RxB0+	Even Pixel Data	
14	GND	Ground(0V)	2)
15	RxB1-	LVDS	1)
16	RxB1+	Even Pixel Data	
17	GND	Ground(0V)	2)
18	RxB2-	LVDS	1)
19	RxB2+	Even Pixel Data	
20	RxBC-	LVDS	1)
21	RxBC+	Even Pixel Clock	
22	RxB3-	LVDS	1)
23	RxB3+	Even Pixel Clock	
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		

Notes 1) RxAn+/-, RxBn+/-, (n=0~5), CLKA+/- and CLKB+/- should be wired by side-by-side FPC patterns, respectively.

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.).

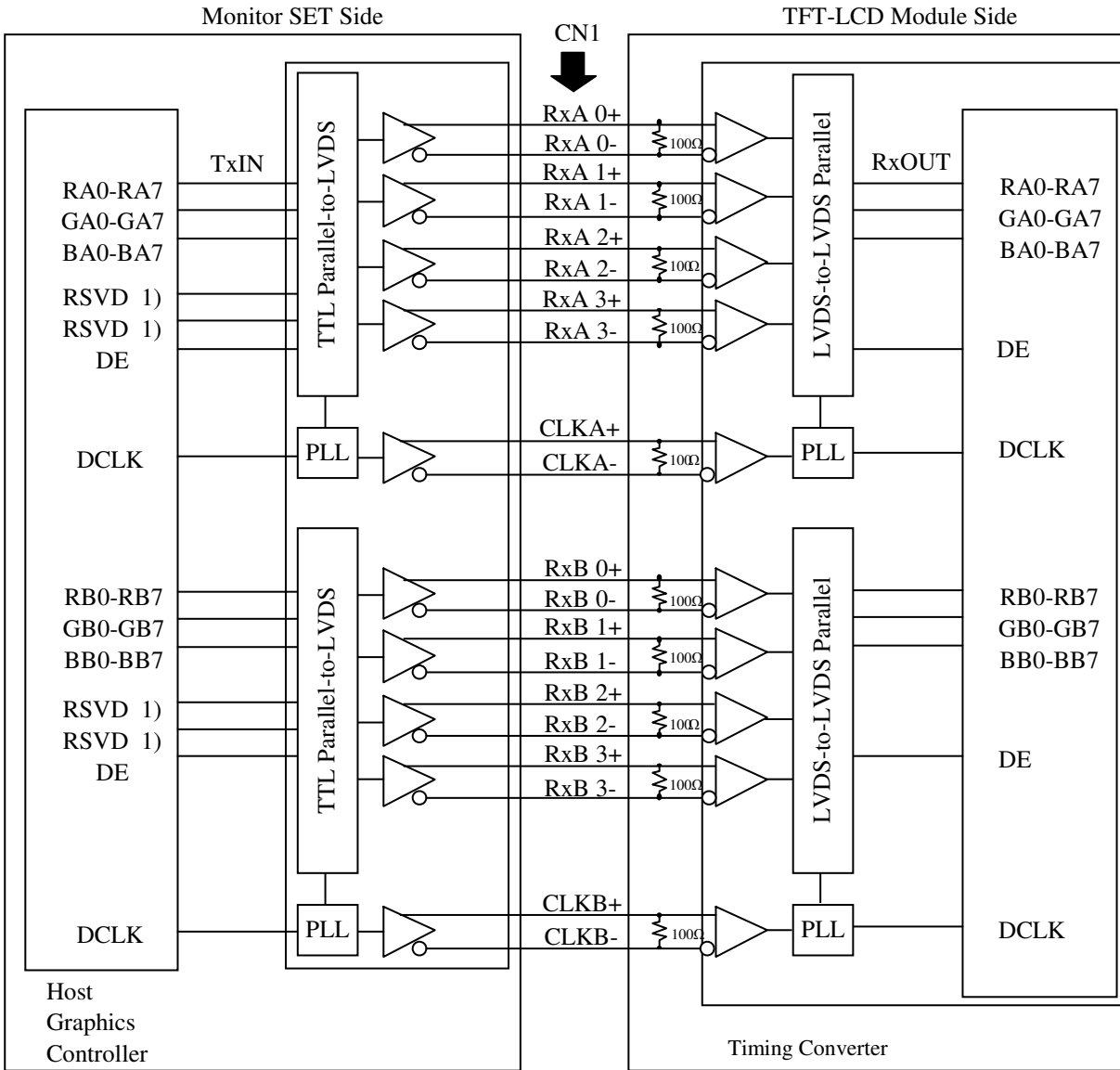
## 5.2 Back light unit

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

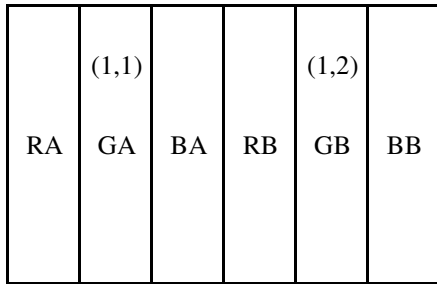
	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER		TFT CONTROL
		PIN	INPUT	Monitor Set	TFT-LCD	PIN	OUTPUT	INPUT
24bit	RA0/RB0	51	Tx IN0	TA OUT0+	RxA/B 0+	27	Rx OUT0	RA0/RB0
	RA1/RB1	52	Tx IN1			29	Rx OUT1	RA1/RB1
	RA2/RB2	54	Tx IN2			30	Rx OUT2	RA2/RB2
	RA3/RB3	55	Tx IN3			32	Rx OUT3	RA3/RB3
	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	TA OUT1+	RxA/B 1+	37	Rx OUT7	GA0/GB0
	GA1/GB1	6	Tx IN8			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	TA OUT1-	RxA/B 1-	46	Rx OUT14	GA5/GB5
	BA0/BB0	15	Tx IN15			47	Rx OUT15	BA0/BB0
	BA1/BB1	19	Tx IN18			51	Rx OUT18	BA1/BB1
	BA2/BB2	20	Tx IN19			53	Rx OUT19	BA2/BB2
	BA3/BB3	22	Tx IN20			54	Rx OUT20	BA3/BB3
	BA4/BB4	23	Tx IN21	TA OUT2+	RxA/B 2+	55	Rx OUT21	BA4/BB4
	BA5/BB5	24	Tx IN22	TA OUT2-	RxA/B 2-	1	Rx OUT22	BA5/BB5
	HSYNC or RSVD1)	27	Tx IN24			3	Rx OUT24	HSYNC or RSVD1)
	VSYNC or RSVD1)	28	Tx IN25			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
	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	TxCLK OUT+ TxCLK OUT-	RxCCLKA/B IN+ RxCCLKA/B IN-	2	Rx OUT23	RSVD 1)	
DCLK	31	TxCLK IN			26	RxCCLK 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".

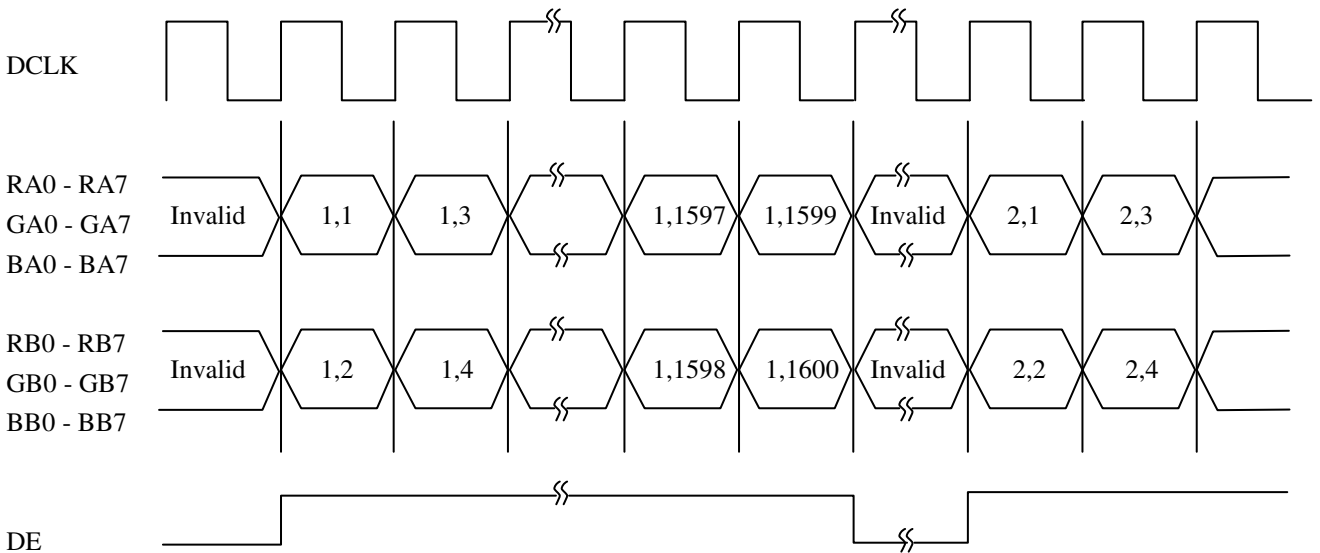
5. 5 Correspondence between input data and display image

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



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

Input Color		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 :

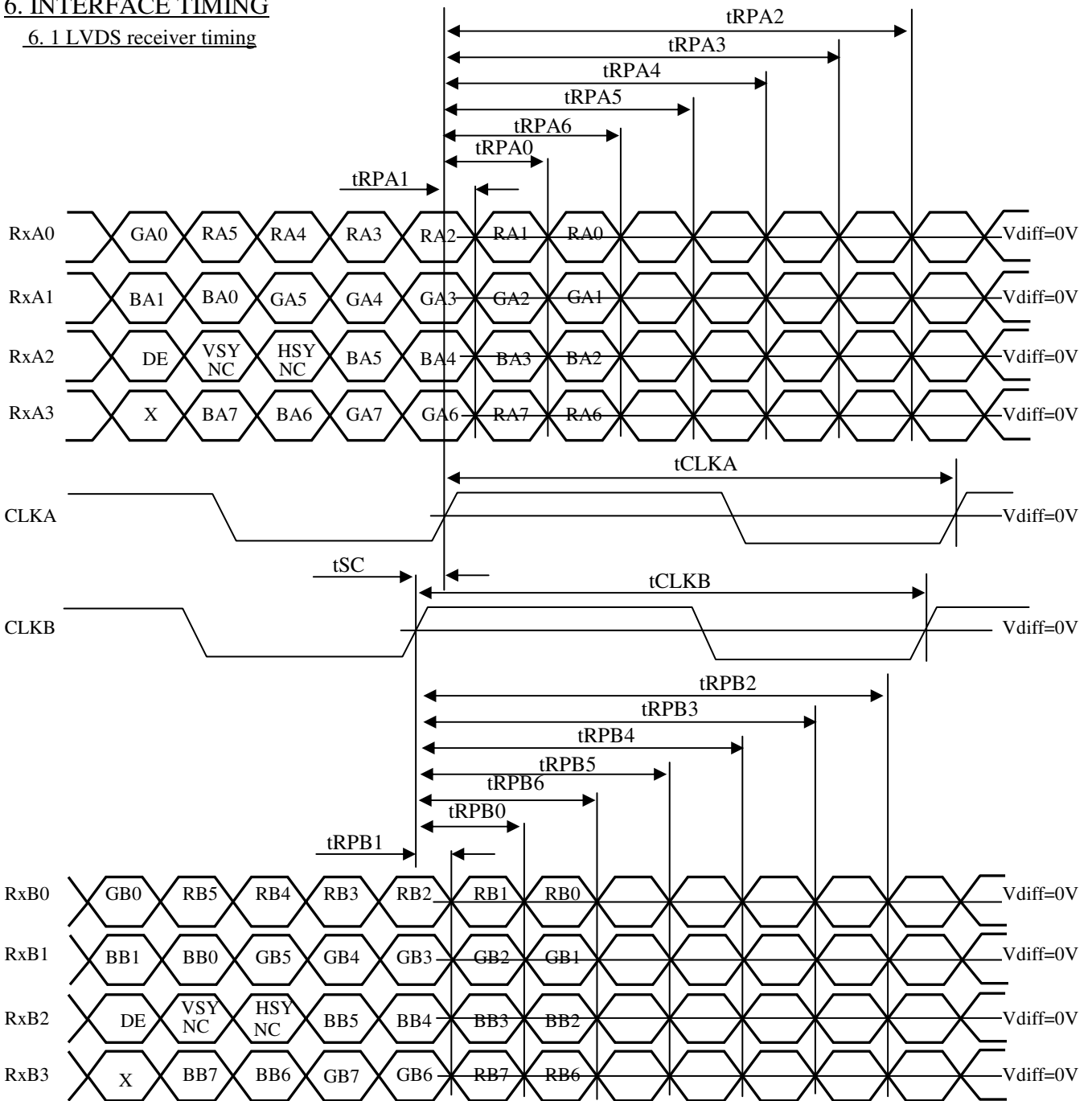
Color(n) . . . . Number in parenthesis indicates gray scale level.

Larger n corresponds to brighter level.

2) Data : 1 : High, 0 : Low

## 6. INTERFACE TIMING

### 6.1 LVDS receiver timing



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

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

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

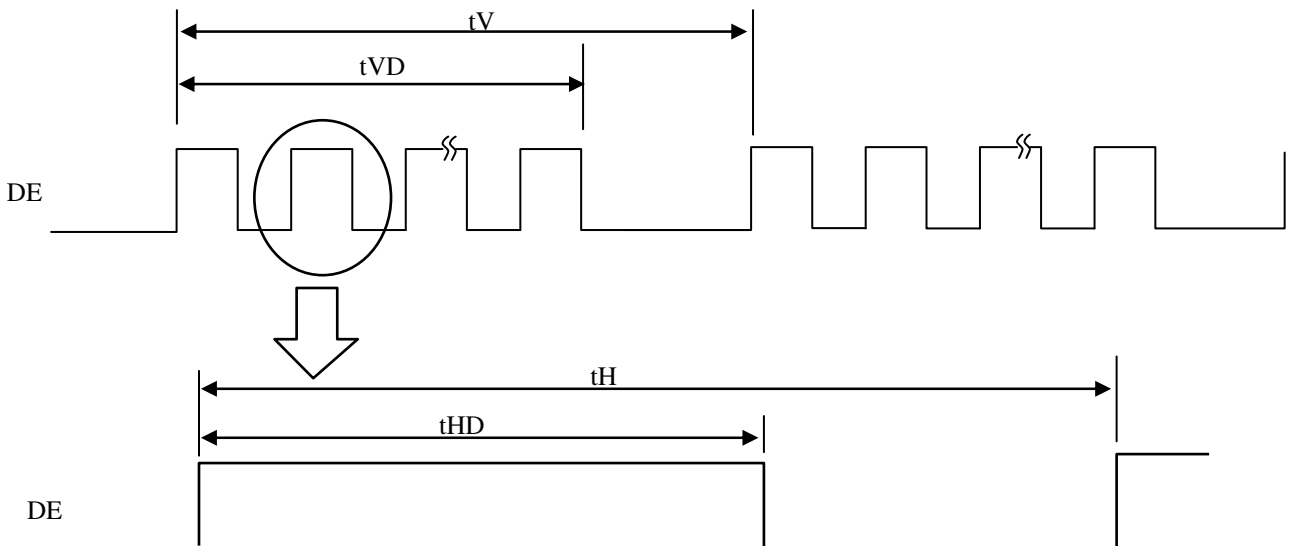
$$CLK=(CLK+)-(CLK-)$$

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

	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 Synchronization signal timing

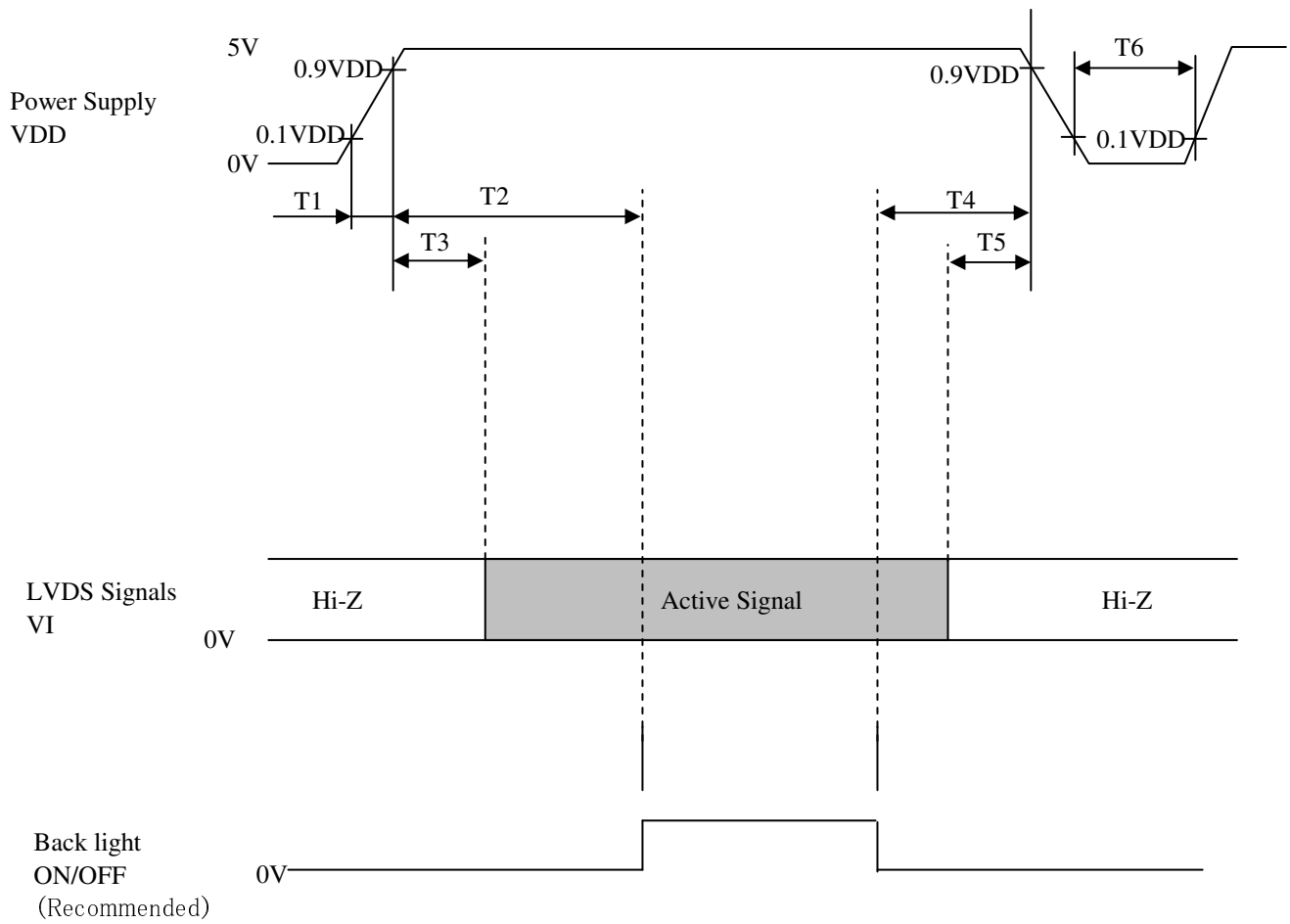


Note 1) The timing of DCLK to other signals conforms to the specifications of LVDS transmitter.

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	

2pxl/clock

### 6.3 Timing between interface signals power supply



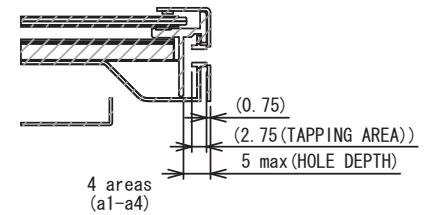
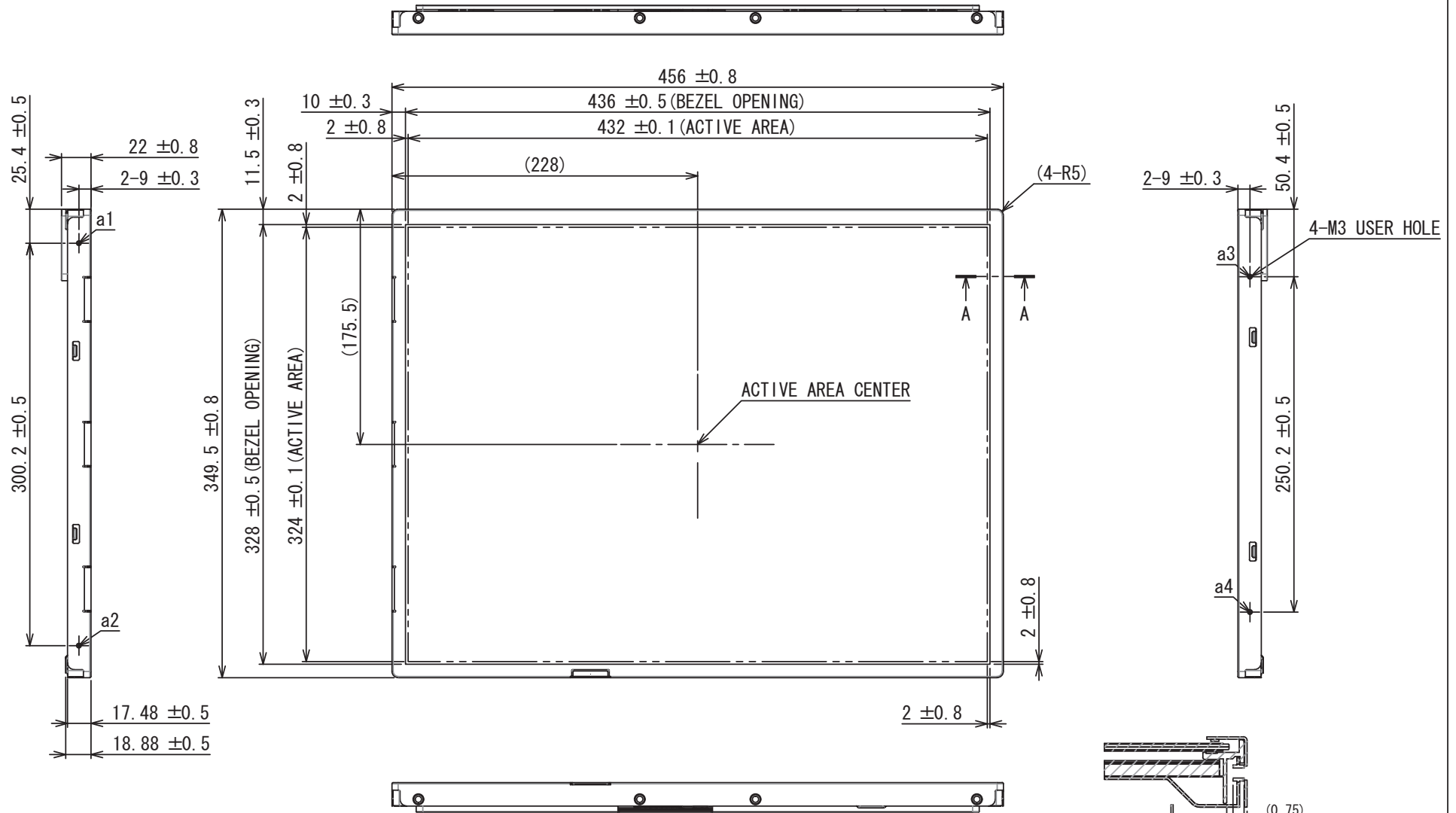
$$\begin{array}{ll}
 0 \leq T1 \leq 10 & 0 \leq T4 \\
 (500) \leq T2 & 0 \leq T5 \\
 (10) \leq T3 & (1000) \leq T6
 \end{array}$$

Unit : ms

# 7. Dimensional Outline

## (1) Front view

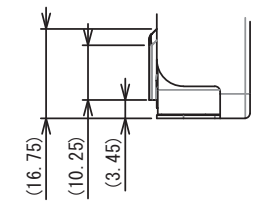
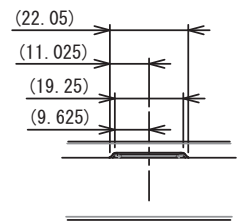
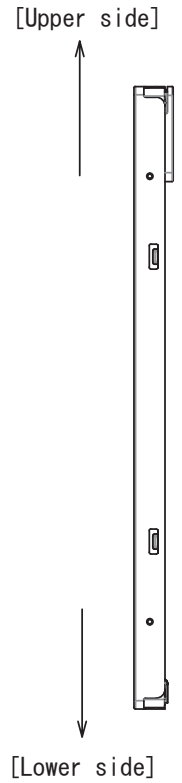
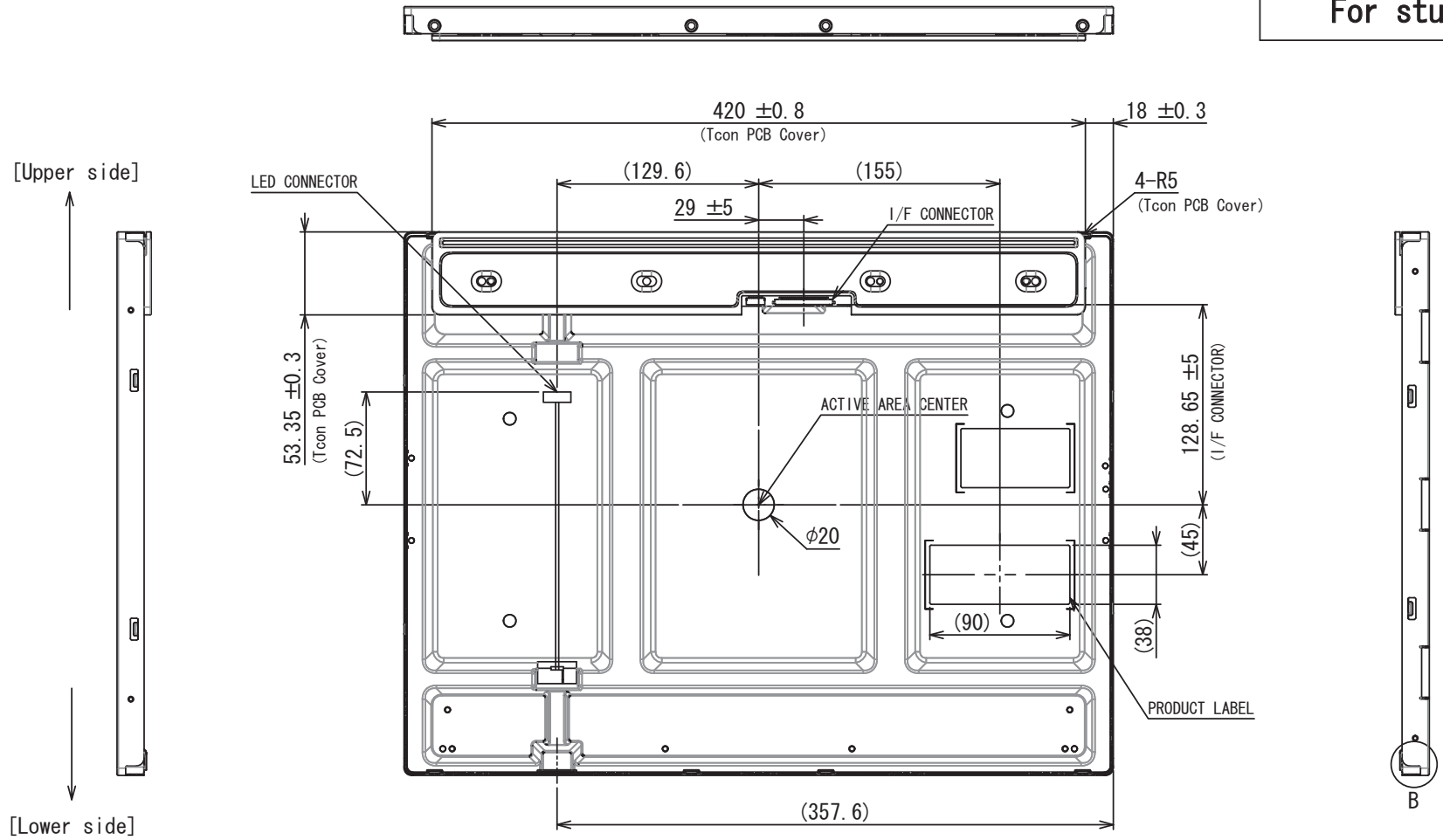
TENTATIVE  
For study only.



- Note1) The dimension in a parenthesis is a reference value.
- 2) The measuring method depends on Panasonic Liquid Crystal Display Co., Ltd standard.
- 3) Warp quantity ≤ 1mm.

(2) Back view

TENTATIVE  
For study only.



Detail C(2:3)

Detail B(1:1)