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# **Product Specification**

## **2.5" COLOR TFT-LCD MODULE**

MODEL NAME: A025CN01 V6/1-N

<◆> Preliminary Specification

< > Final Specification

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## Record of Revision

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## A. Physical specifications

NO.	Item	Specification	Remark
1	Display resolution (dot)	480(W)×234(H)	
2	Active area (mm)	49.2(W)×38.142(H)	
3	Screen size (inch)	2.45(Diagonal)	
4	Dot pitch (mm)	0.1025(W)×0.163(H)	
5	Color configuration	R. G. B. delta	
6	Overall dimension (mm)	59.9(W)×50.4(H)×4.2(D)	Note 1
7	Weight (g)	TBD	

Note 1: Refer to Fig. 1

## B. Electrical specifications

### 1.Pin assignment: Signal FPC

Pin No.	Symbol	I/O	Description	Remark
01	GND		Ground for logic circuit	
02	VCC		Supply voltage of logic control circuit for scan driver	
03	VGL	I	Negative power for scan driver	
04	VGH	I	Positive power for scan driver	
05	STVR	I/O	Vertical start pulse	
06	STVL	I/O	Vertical start pulse	
07	CKV	I	Shift clock input for scan driver	
08	U/D	I	Up/Down scan control input	
09	OEV	I	Output enable input for scan driver	
10	VCOM	I	Common electrode driving signal	
11	VCOM	I	Common electrode driving signal	
12	NC			
13	NC			
14	NC			
15	NC			
16	L/R	I	Left/Right scan control input	
17	Q1H	I	Analog signal rotate input	
18	OEH	I	Output enable input for data driver	
19	STHL	I/O	Start pulse for horizontal scan line	
20	STHR	I/O	Start pulse for horizontal scan line	
21	CPH3	I	Sampling and shifting clock pulse for data driver	
22	CPH2	I	Sampling and shifting clock pulse for data driver	
23	CPH1	I	Sampling and shifting clock pulse for data driver	
24	DVDD		Supply voltage of logic control for data driver	
25	DVSS		Ground for logic circuit	
26	VA	I	Alternated video signal input (Red)	
27	VB	I	Alternated video signal input (Green)	
28	VC	I	Alternated video signal input (Blue)	
29	AVDD		Supply voltage for analog circuit	
30	AVSS		Ground for analog circuit	

## 2. Pin assignment: LED Power FPC

Pin no	Symbol	I/O	Description	Remark
1			N/C	
2			N/C	
3	GLED		LED module Anode	Note 2
4	VLED		LED module Cathode	Note 2

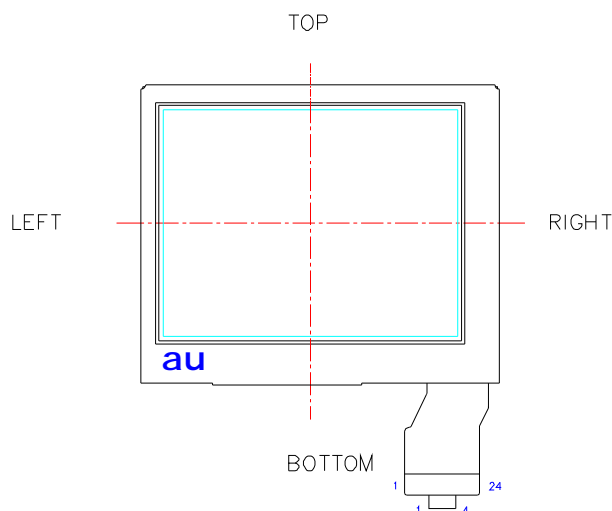
Note 1 : Selection of scanning mode

Setting of scan control input		IN/OUT state For start pulse				Scanning direction
U/D	L/R	STVR	STVL	STHR	STHL	
GND	V <sub>CC</sub>	OUT	IN	OUT	IN	From up to down, and from left to right.
V <sub>CC</sub>	GND	IN	OUT	IN	OUT	From down to up, and from right to left.
GND	GND	OUT	IN	IN	OUT	From up to down, and from right to left.
V <sub>CC</sub>	V <sub>CC</sub>	IN	OUT	OUT	IN	From down to up, and from left to right.

IN: Input; OUT: Output.

Note 2 : Definition of scanning direction.

Refer to figure as below:



## a. LED driving conditions(Refer to Fig.1)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
<b>LED current</b>			<b>20</b>		<b>mA</b>	
LED voltage	$V_L$		<b>13.2</b>		<b>V</b>	
LED Life Time	$L_L$	8000			Hr	Note 1,2

Note 1 :  $T_a = 25^{\circ}\text{C}$ ,  $I_L = 20\text{mA}$ 

Note 2 : Brightness to be decreased to 50% of the initial value.

## 3. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	VCC	GND=0	-0.3	7	V	
	AVDD	AVSS=0	-0.3	7	V	
	VGH	GND=0	-0.3	18	V	
	VGL		-18	0.3	V	
	VGH – VGL		-	36	V	
Input signal voltage	$V_i$		-0.3	$AV_{DD}+0.3$	V	Note 1
	$V_I$		-0.3	$V_{CC}+0.3$	V	Note 2
	VCOM		-2.9	5.2	V	
Operating temperature	Topa		0	60	$^{\circ}\text{C}$	Ambient temperature
Storage	Tstg		-25	80	$^{\circ}\text{C}$	Ambient temperature

Note 1: VR, VG, VB

Note 2: STHL, STHR, Q1H,OEH,L/R,CPH1~CPH3, STVR, STVL,OEV,CKV,U/D.

## 4. Electrical characteristics

## a. Typical operating conditions (GND=AVss=0V)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	$V_{CC}$	3	5	5.2	V	
	$AV_{DD}$	4.5	5	5.2	V	
	$V_{GH}$	14.3	15	15.7	V	
	$V_{GLAC}$	3.5	5	7.5	Vp-p	AC component of $V_{GL}$ .
	$V_{GL-H}$	-10	-9.5	-9	V	High level of $V_{GL}$ .
Video signal	$V_{iA}$	$AV_{SS}+0.4$	-	$AV_{DD}-0.4$	V	Note 2
	$V_{iAC}$	-	3	-	V	AC component



		$V_{IDC}$	-	$AV_{DD}/2$	-	V	DC component
VCOM		$V_{CAC}$	3.5	5	7.5	Vp-p	AC component, Note 3
		$V_{CDC}$	0.95	1.1	1.25	V	DC component
Input Signal voltage	H Level	$V_{IH}$	$0.8 V_{CC}$	-	$V_{CC}$	V	Note 4
	L Level	$V_{IL}$	0	-	$0.2 V_{CC}$	V	

Note 1: The same phase and amplitude with common electrode driving signal(VCOM).

Note 2: Refer to Fig.4-(a)

Note 3: The brightness of LCD panel could be adjusted by the adjustment of the AC component of VCOM.

Note 4: STHL,STHR,Q1H,OEHL,R,CPH1~CPH3,STVR,STVL,OEVL,CKV,U/D.

Note 5: Be sure to apply GND,  $V_{CC}$ ,  $V_{GL}$  to the LCD first, and then apply  $V_{GH}$ .

#### b. Current consumption (GND=AVss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for driver	IGH	VGH=15V	-	50	100	$\mu A$	
	IGL	VGL-H=-10V	-	-0.3	-0.6	mA	
	ICC	VCC=5V	-	1.5	4	mA	
	IDD	AVDD=5V	-	5	10	mA	

#### c. Backlight driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	$I_L$		(20)		mArms	
LED voltage	$V_L$		15		Vrms	Note 1
Backlight Life		(10000)			Hr	Note 1, 2

Note 1 : Ta. = 25°C,  $I_L = 20mA$

The voltage ( $V_L$ ) is dependent on customer design for serial or parallel consideration of 4 LEDs.

Note 2 : Brightness to be decreased to 50% of the initial value.

## 5. AC Timing

#### a. Timing conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Rising time	$t_r$	-	-	10	ns	Note 1
Falling time	$t_f$	-	-	10	ns	Note 1
High and low level pulse width	$t_{CPH}$	299	308	319	ns	CPH1~CPH3
CPH pulse duty	$t_{CWH}$	40	50	60	%	CPH1~CPH3
CPH pulse delay	$t_{C12}$	70	$t_{CPH}/3$	$t_{CPH}/2$	ns	CPH1~CPH3
	$t_{C23}$					
STH setup time	$t_{SUH}$	35	-	-	ns	STHR,STHL

STH hold time	$t_{HDH}$	35	-	-	ns	STHR,STHL
STH pulse width	$t_{STH}$	-	1	-	$t_{CPH}$	STHR,STHL
STH period	$t_H$	61.5	63.5	65.5	$\mu s$	STHR,STHL
OEH pulse width	$t_{OEH}$	-	3	-	$t_{CPH}$	OEH
Sample and hold disable time	$t_{DIS1}$	-	28	-	$t_{CPH}$	
OEV pulse width	$t_{OEV}$	-	12	-	$t_{CPH}$	OEV
CKV pulse width	$t_{CKV}$	16	28	40	$t_{CPH}$	CKV
Clean enable time	$t_{DIS2}$	-	10	-	$t_{CPH}$	
Horizontal display start	$t_{SH}$	-	0	-	$t_{CPH}/3$	
Horizontal display	$t_{DH}$	-	480	-	$t_{CPH}/3$	
STV setup time	$t_{SUV}$	400	-	-	ns	STVL,STVR
STV hold time	$t_{HDV}$	400	-	-	ns	STVL,STVR
STV pulse width	$t_{STV}$	-	-	1	$t_H$	STVL,STVR
Horizontal lines per field	$t_V$	256	262	268	$t_H$	Note 2
Vertical display start	$t_{SV}$	-	3	-	$t_H$	
Vertical display timing range	$t_{DV}$	-	234	-	$t_H$	
VCOM rising time	$t_{rCOM}$	2	-	3	$\mu s$	
VCOM falling time	$t_{fCOM}$	2	-	3	$\mu s$	
VCOM delay time	$t_{DCOM}$	-	-	3	$\mu s$	
RGB delay time	$t_{DRGB}$	-	-	1	$\mu s$	

Note 1: For all of the logic signals.

Note 2: Please don't use odd horizontal lines to drive LCD panel for both odd and even fields simultaneously.

#### b. Timing diagram

Please refer to the attached drawings, from Fig.2 to Fig.6.

### C. Optical specification (Note 1, Note 2, Note 3)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	$\theta = 0^\circ$	-	20	30	ms	Note 4, 6
	Fall		-	30	40	ms	
Contrast ratio	CR	At optimized viewing angle	100	150	-		Note 5, 6
Viewing angle	Top	$CR \geq 10$	10	-	-	deg.	Note 6, 7
	Bottom		30	-	-		
	Left		45	-	-		
	Right		45	-	-		
Brightness	YL	$\theta = 0^\circ$	170	210	-	nit	Note 8
White chromaticity	X	$\theta = 0^\circ$	0.26	0.31	0.36		Note 8
	y		0.3	0.35	0.4		

Note 1. Ambient temperature  $= 25^\circ\text{C}$ . and lamp current  $I_L = 2.7\text{mA}_{rms}$ .

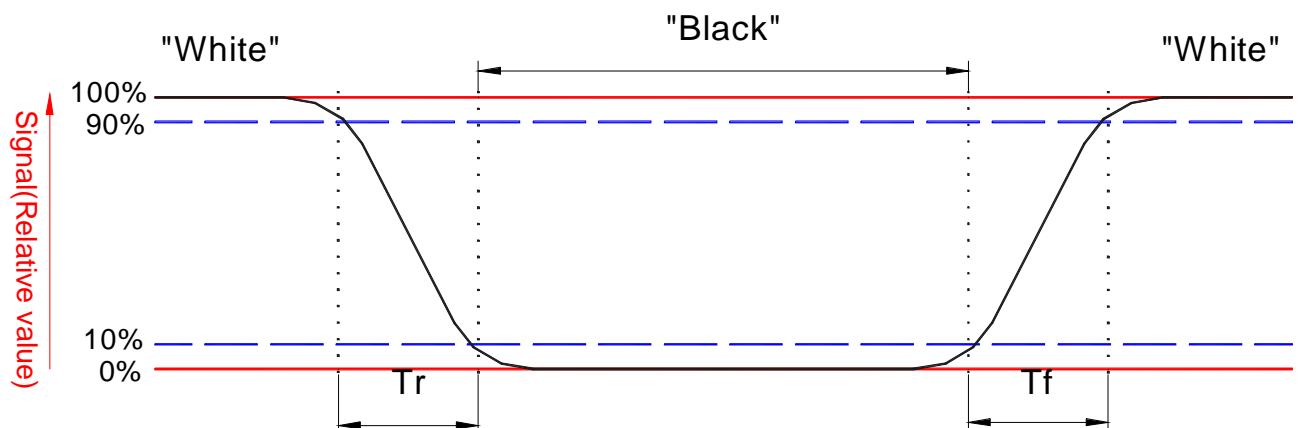
Note 2. To be measured in the dark room.

Note 3. To be measured at the center area of panel with a viewing cone of  $1^\circ$  by Topcon luminance meter BM-7, after 10 minutes operation.

Note 4. Definition of response time:

The output signals of photodetector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photodetector output when LCD is at "White" state}}{\text{Photodetector output when LCD is at "Black" state}}$$

Note 6. White  $V_i = V_{i50} \mp 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

“ $\pm$ ” means that the analog input signal swings in phase with COM signal.

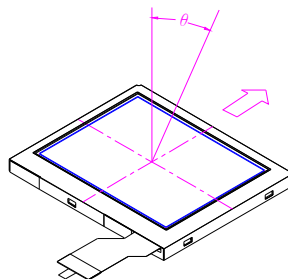
“ $\mp$ ” means that the analog input signal swings out of phase with COM signal.

$V_{i50}$  : The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 7. Definition of viewing angle:

Refer to figure as below.



Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

**D. Reliability test items:**

No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 80°C 168H	
2	Low temperature storage	Ta= -25°C 168H	
3	High temperature operation	Ta= 60°C 168H	
4	Low temperature operation	Ta= 0°C 168H	
5	High temperature and high humidity	Ta= 60°C . 90% RH 168H	Operation
6	Heat shock	-25°C ~80°C/50 cycle 2H/cycle	Non-operation
7	Electrostatic discharge	±200V,200pF(0Ω), once for each terminal	Non-operation
8	Vibration	Frequency range : 10~55Hz Stoke : 1.5mm Sweep : 10~55Hz~10Hz 2 hours for each direction of X,Y,Z (6 hours for total)	JIS C7021, A-10 condition A
9	Mechanical shock	100G . 6ms, ±X,±Y,±Z 3 times for each direction	JIS C7021, A-7 condition C
10	Vibration (with carton)	Random vibration: 0.015G <sup>2</sup> /Hz from 5~200Hz	IEC 68-34
11	Drop (with carton)	Height: 80cm	

Note: Ta: Ambient temperature.

MODEL(A02PCHO3)  
97.02A08.000

PS TRAY  
81.02A08.001

TRAY TURN 180°  
ONE STRATUM OF 10 PCS

21 LAYER  
20 LAYERS TO PUT 200 PCS

A/S BAG  
79.02A02.004

OPEN

TAPE(60mm)  
80.01A09.006

TAPE(60mm)  
80.01A09.006

TAPE(60mm)  
80.01A09.006

TAPE(60mm)  
80.01A09.006

CUSHION\_EPE  
84.02A02.005

CUSHION\_EPE  
84.02A02.006

CUSHION\_EPE  
84.02A02.007

CUSHION\_EPE  
84.02A02.006

CUSHION\_EPE  
84.02A02.005

TAPE(60mm)  
80.01A09.006

CARTON  
81.01A09.003

MAX. CAPACITY :200 MODULES  
MAX. WEIGHT : 8 kg  
MEAS. 520mm\*340mm\*250mm

NOTES:

1. General tolerance is  $\pm 0.3$
2. The bending radius of FPC should be larger than 0.6

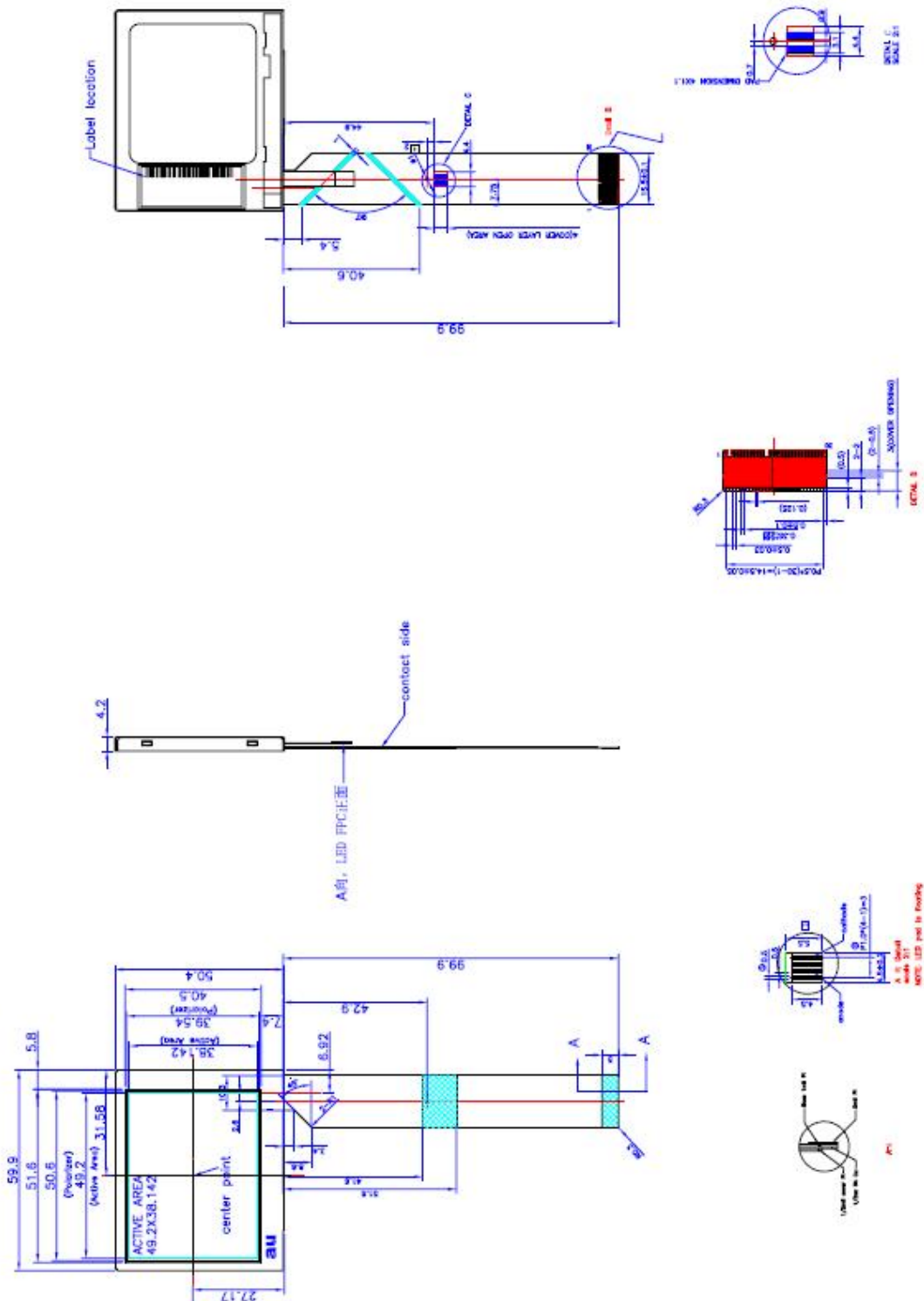
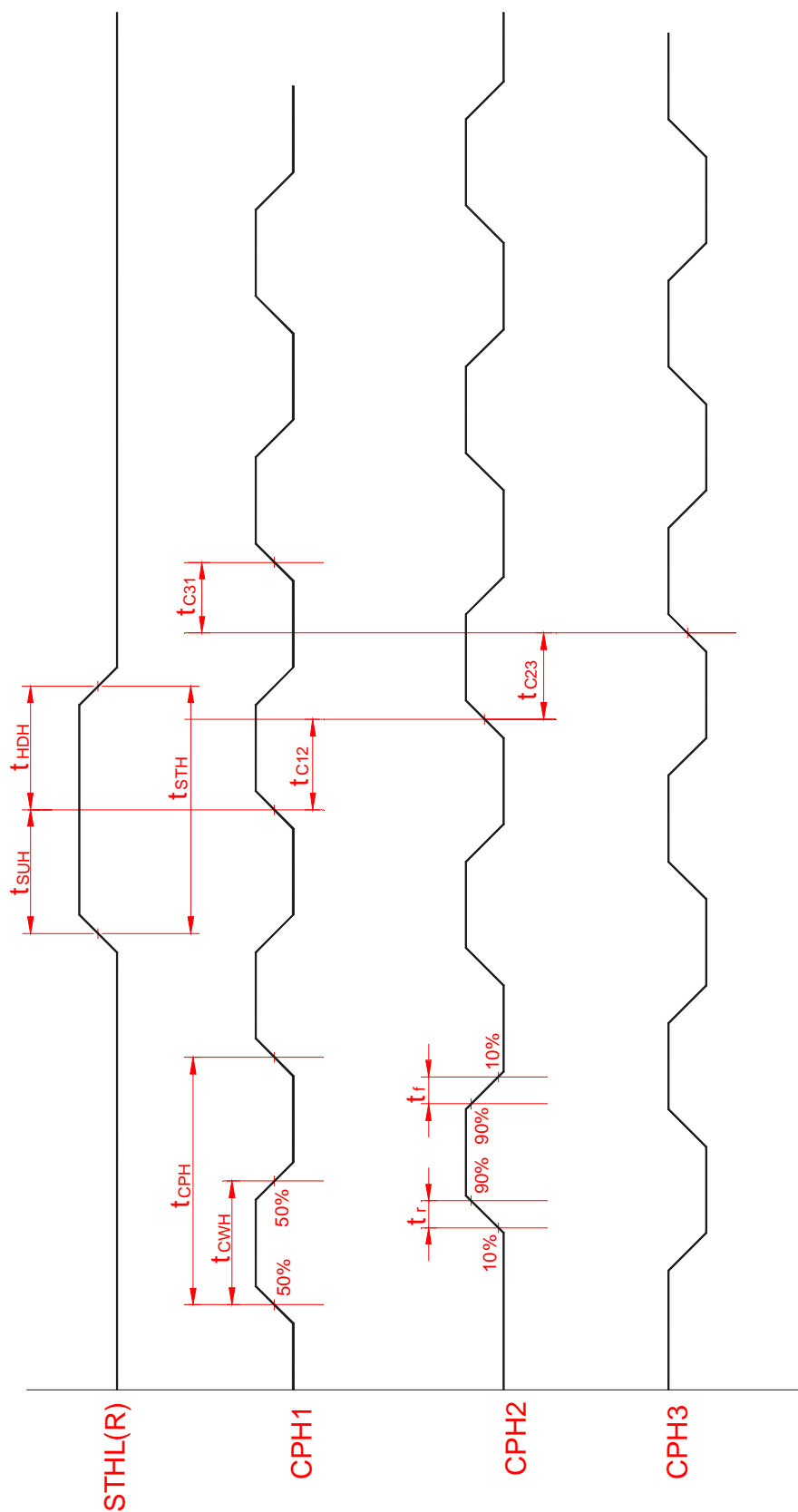
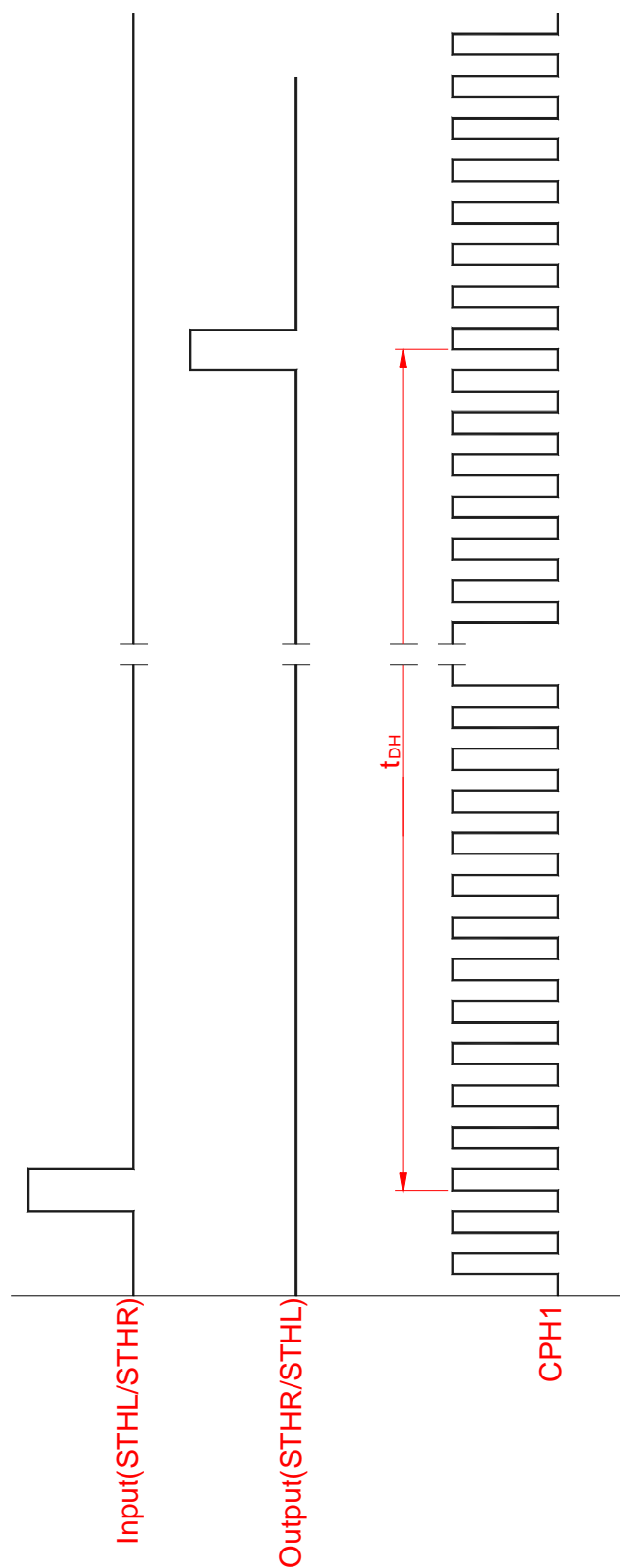


Fig.1.1 Outline dimension of TFT-LCD module

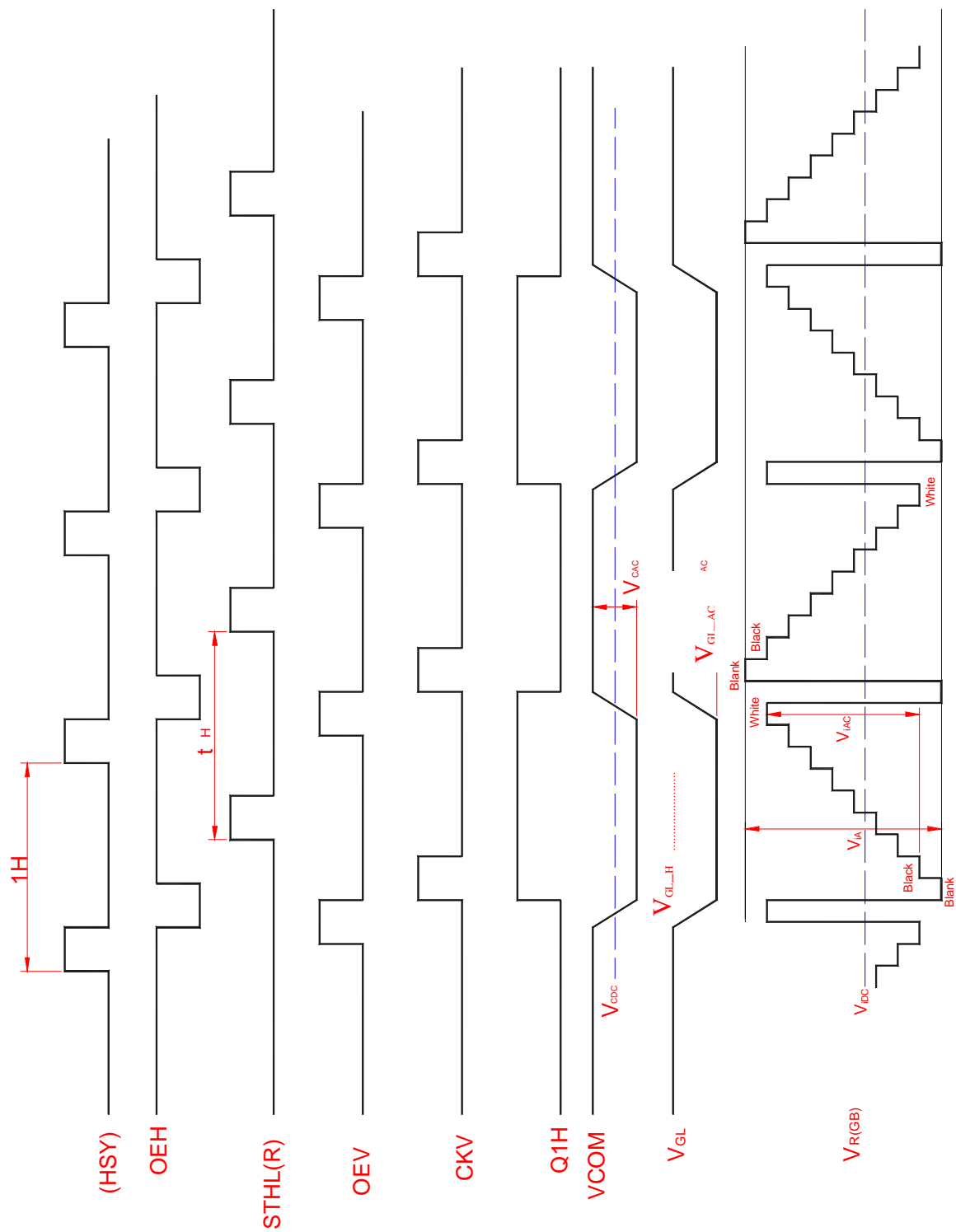


**Fig.2 Sampling clock timing**

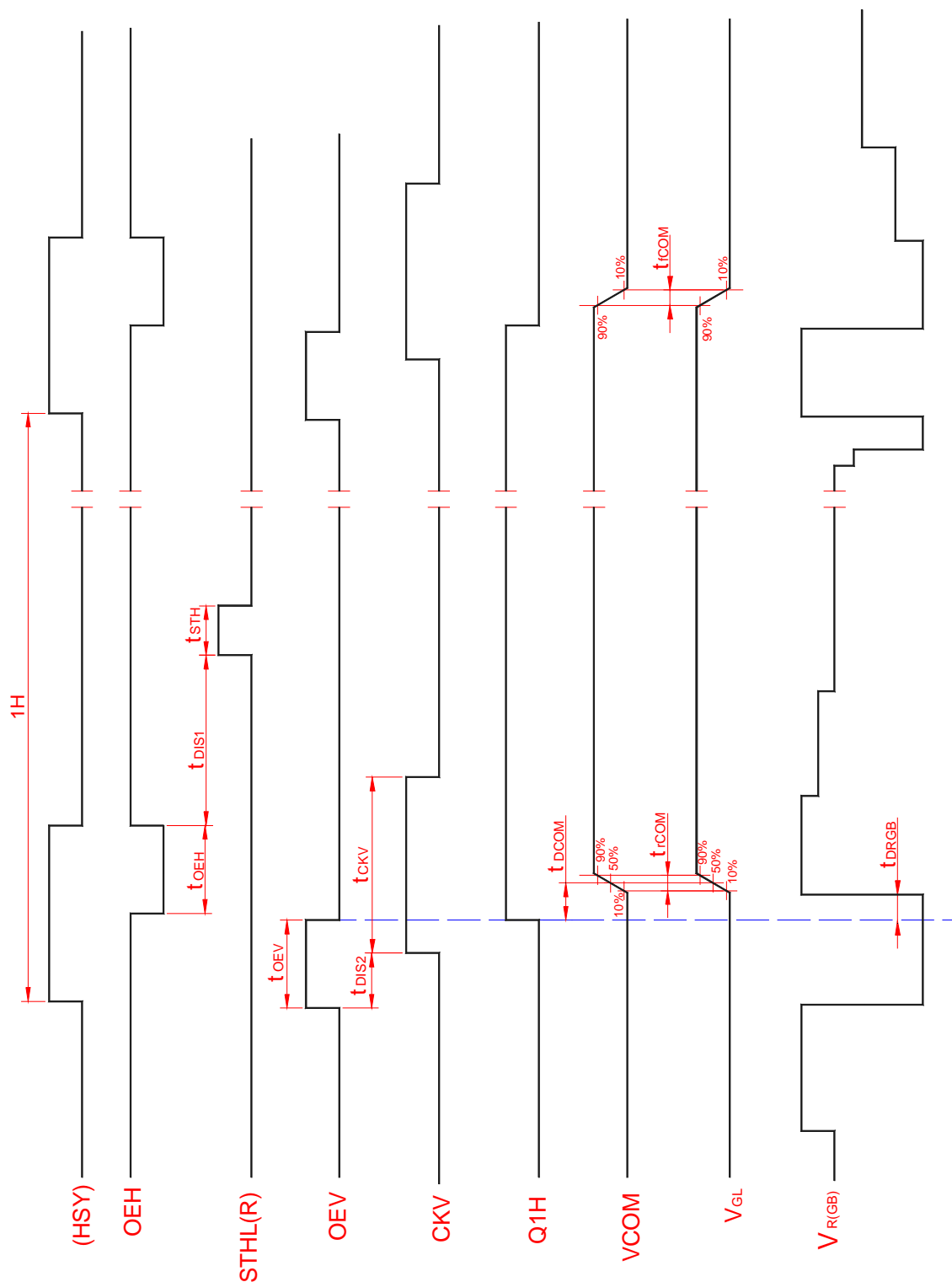




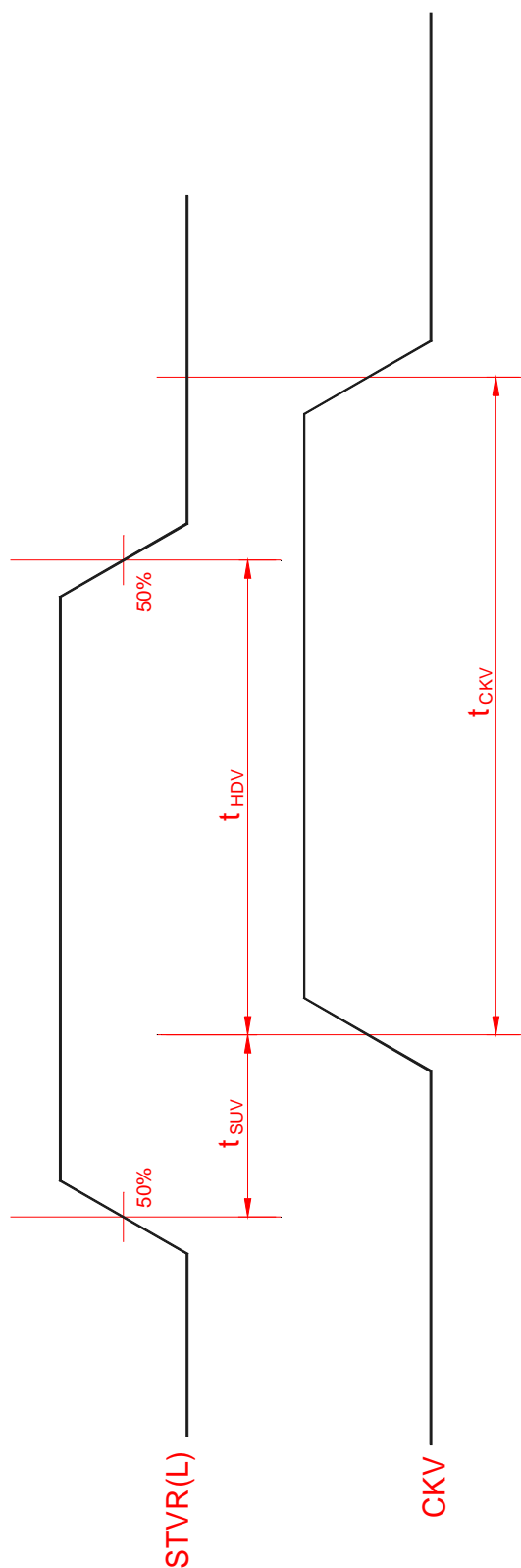
**Fig.3 Horizontal display timing range**



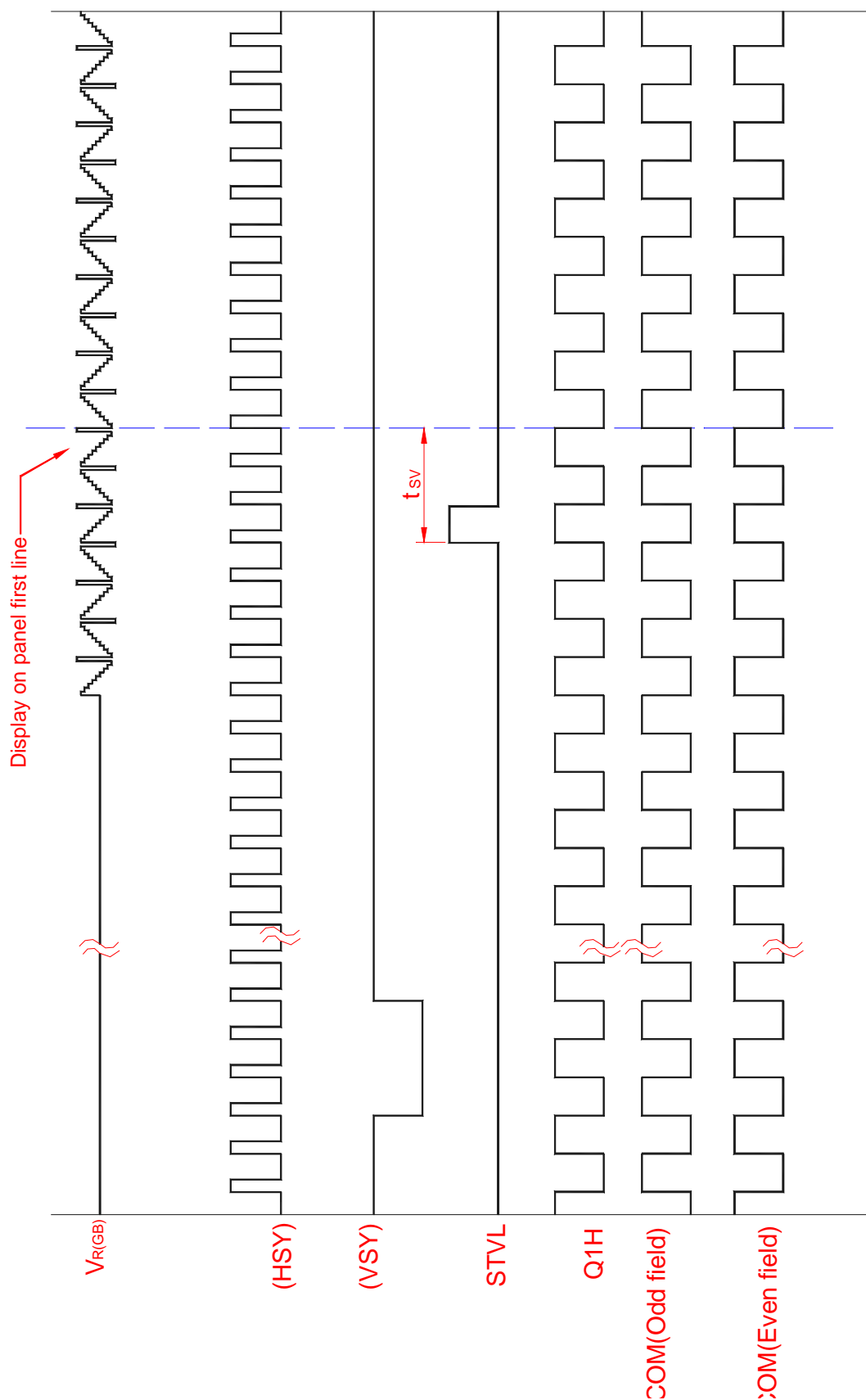
**Fig.4(a) Horizontal timing**



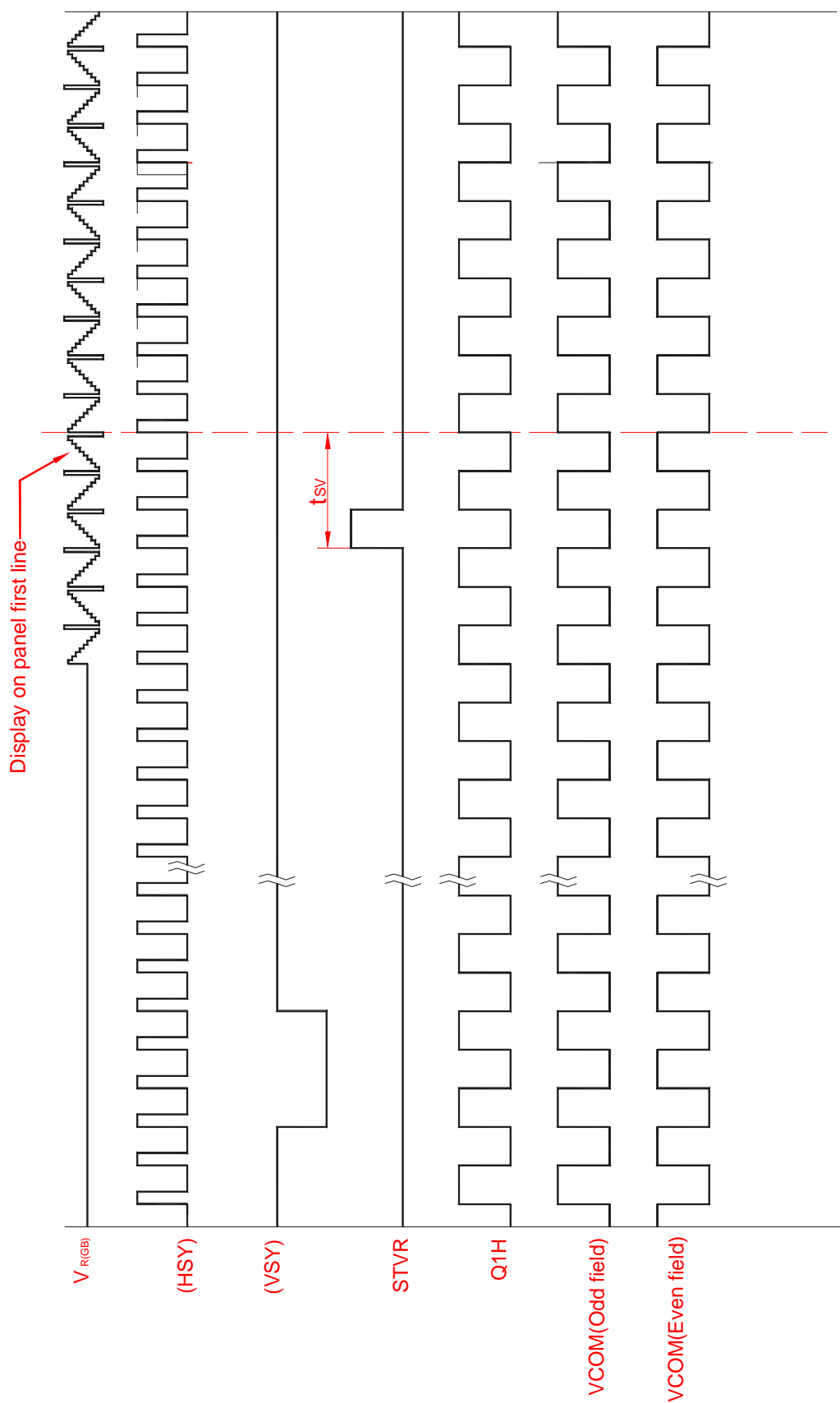
**Fig.4-(b) Detail horizontal timing**



**Fig.5 Vertical shift clock timing**



**Fig.6-(a) Vertical timing (From up to down)**



**Fig.6-(b) Vertical timing (From down to up)**