



Spec. No.	
Doc. version:	0.3
Total pages:	22
Date	: 2004/11/26

# Product Specification

## 2.5" COLOR TFT-LCD MODULE

MODEL NAME: A025CN01 V6

<◆>Preliminary Specification

< > Final Specification

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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
1	STHL	I/O	Start pulse for horizontal scan line	Note 1
2	OEH	I	Output enable input for data driver	
3	Q1H	I	Analog signal rotate input	
4	CPH1	I	Sampling and shifting clock pulse for data driver	
5	CPH2	I	Sampling and shifting clock pulse for data driver	
6	CPH3	I	Sampling and shifting clock pulse for data driver	
7	GND	-	Ground	
8	VB	I	Alternated video signal input(Blue)	
9	VG	I	Alternated video signal input(Green)	
10	VR	I	Alternated video signal input(Red)	
11	NC	-	This pin should be electrical opened during operation	
12	L/R	I	Left/Right scan control input	Note 1,2
13	STHR	I/O	Start pulse for horizontal scan line	Note 1
14	AV <sub>DD</sub>	I	Supply voltage for analog circuit	
15	VCOM	I	Common electrode driving signal	
16	V <sub>GH</sub>	I	Positive power for scan driver	
17	V <sub>CC</sub>	I	Logic power for scan & data driver	
18	STVL	I/O	Vertical start pulse	Note 1
19	OEV	I	Output enable input for scan driver	
20	CKV	I	Shift clock input for scan driver	
21	U/D	I	UP/DOWN scan control input	Note 1,2
22	STVR	I/O	Vertical start pulse	Note 1
23	NC	-	This pin should be electrical opened during operation	
24	V <sub>GL</sub>	I	Negative power for scan driver	

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

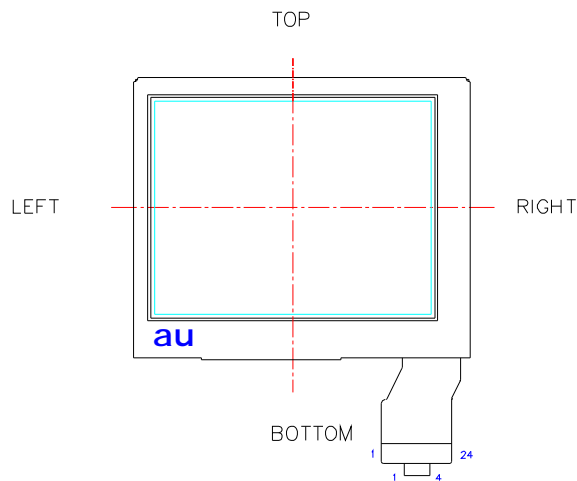
Note 1 : Selection of scanning mode

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
LED current			20		mA	
LED voltage	$V_L$		(15)		V	
LED Life Time	$L_L$	(10000)			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	AV <sub>SS</sub> =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 <sub>DD</sub> +0.3	V	Note 1
	$V_I$		-0.3	V <sub>CC</sub> +0.3	V	Note 2
	VCOM		-2.9	5.2	V	
Operating temperature	Topa		0	60	°C	Ambient temperature
Storage	Tstg		-25	80	°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=AV<sub>SS</sub>=0V)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	V <sub>CC</sub>	3	5	5.2	V	
	AV <sub>DD</sub>	4.5	5	5.2	V	
	V <sub>GH</sub>	14.3	15	15.7	V	
	V <sub>GLAC</sub>	3.5	5	7.5	Vp-p	AC component of V <sub>GL</sub> .
	V <sub>GL-H</sub>	-10	-9.5	-9	V	High level of V <sub>GL</sub> .
Video signal	$V_{iA}$	AV <sub>SS</sub> +0.4	-	AV <sub>DD</sub> -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,OEH,L/R,CPH1~CPH3,STVR,STVL,OEV,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 :  $T_a = 25^\circ C$ ,  $I_L = 20mA$

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	Tr	$\theta = 0^\circ$	-	20	30	ms	Note 4, 6
	Fall	Tf		-	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°C. and lamp current  $I_L = 2.7\text{mA}$  rms.

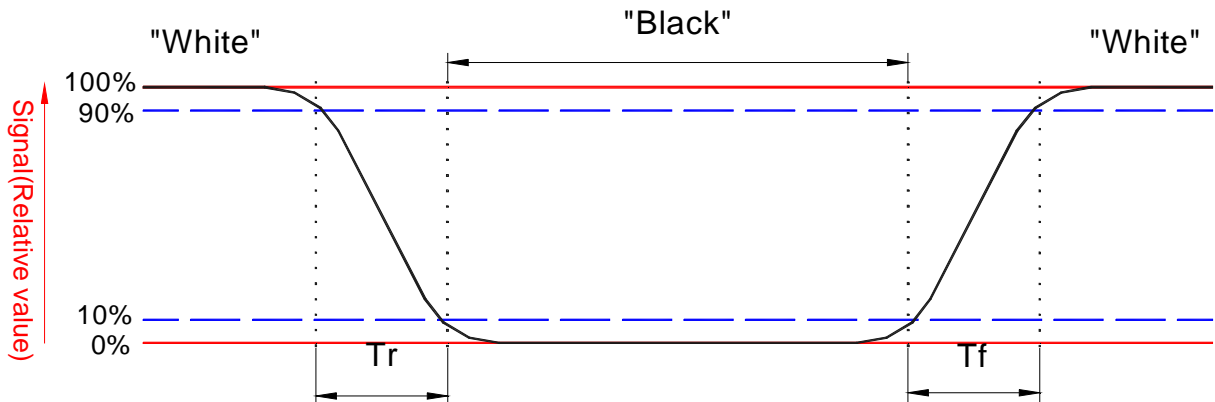
Note 2. To be measured in the dark room.

Note 3. To be measured at the center area of panel with a viewing cone of 1° 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  $V_i = V_{i50} \overset{\pm}{+} 1.5V$

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

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

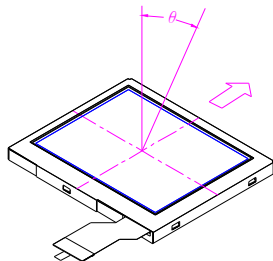
“ $\overset{\pm}{+}$ ” means that the analog input signal swings out of phase with COM signal.

$V_{i50}$  : 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.



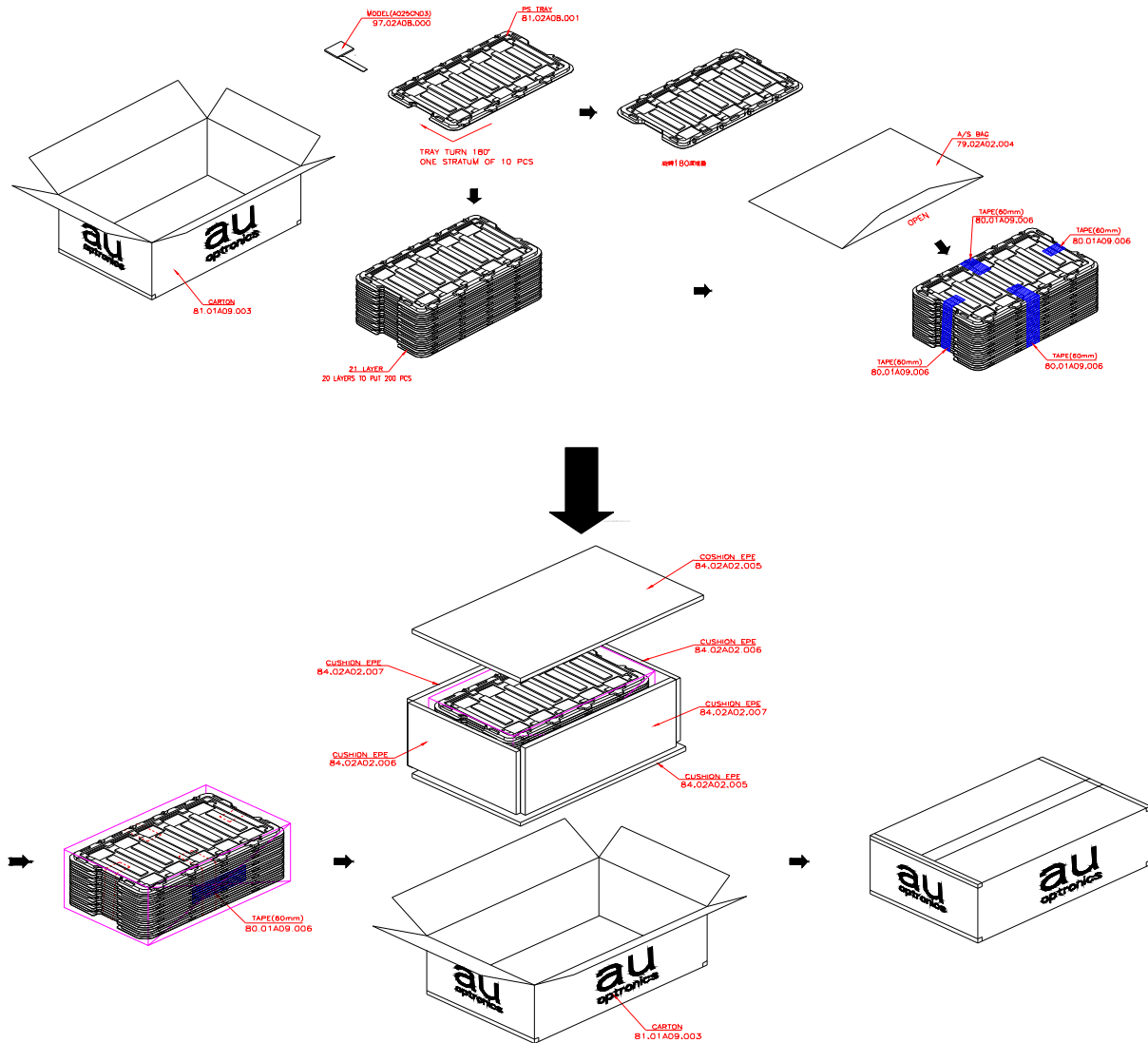
Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

#### D. Reliability test items:

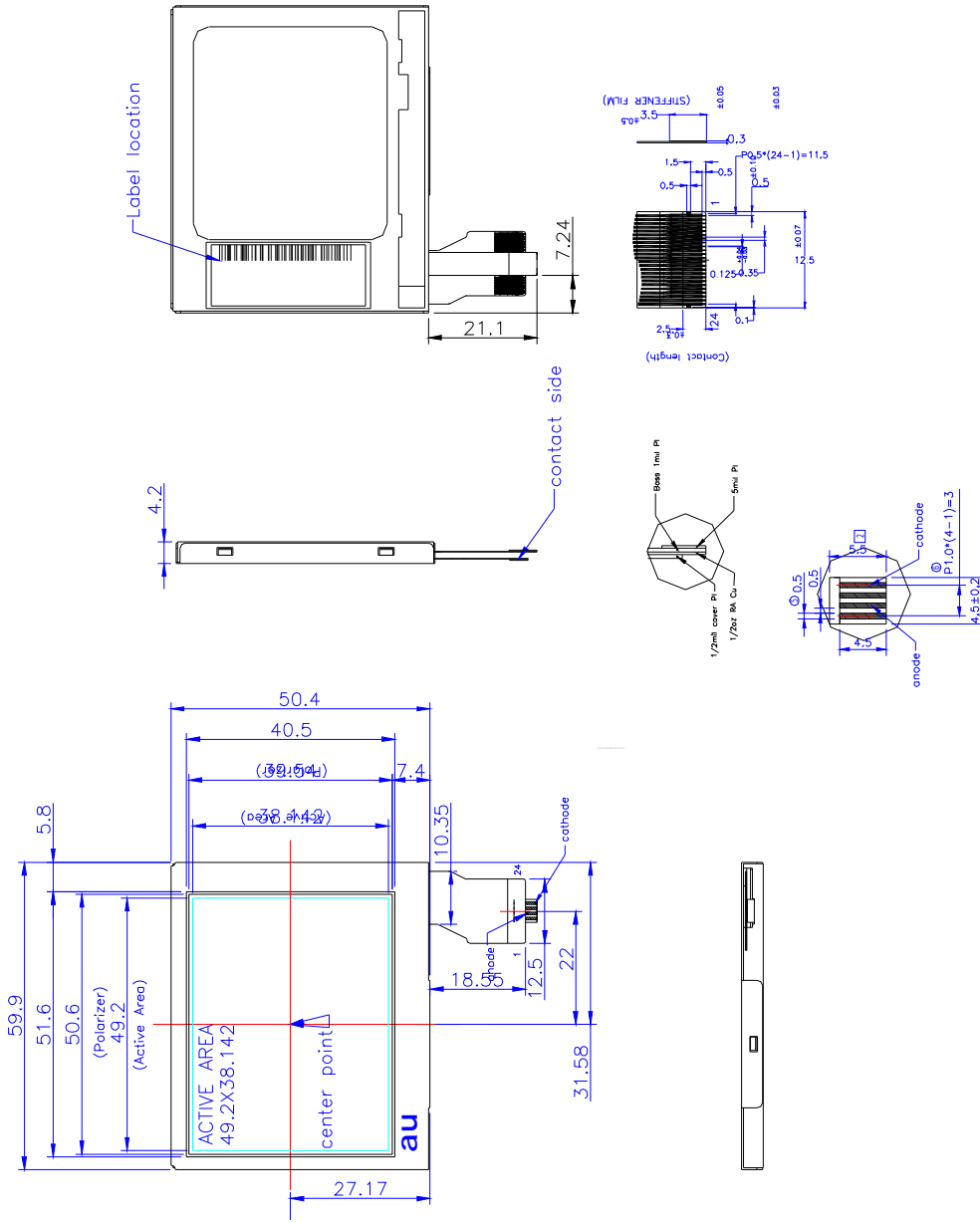
No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 80°C                      240H	
2	Low temperature storage	Ta= -25°C                      240H	
3	High temperature operation	Ta= 60°C                      240H	
4	Low temperature operation	Ta= 0°C                      240H	
5	High temperature and high humidity	Ta= 60°C . 90% RH              240H	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.

### E.Packing form

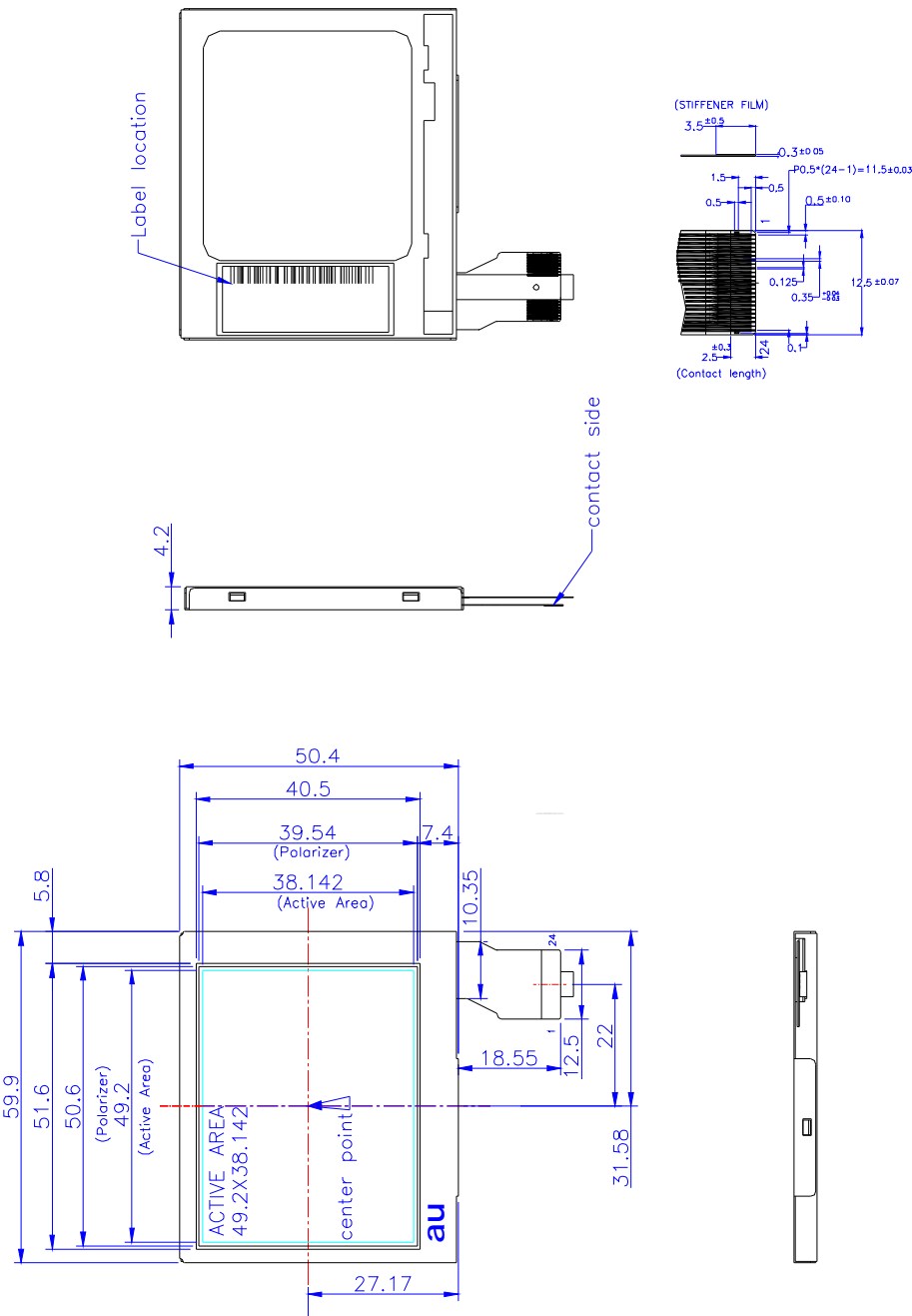


MAX. CAPACITY :200 MODULES  
MAX. WEIGHT : 8 kg  
MEAS. 520mm\*340mm\*250mm



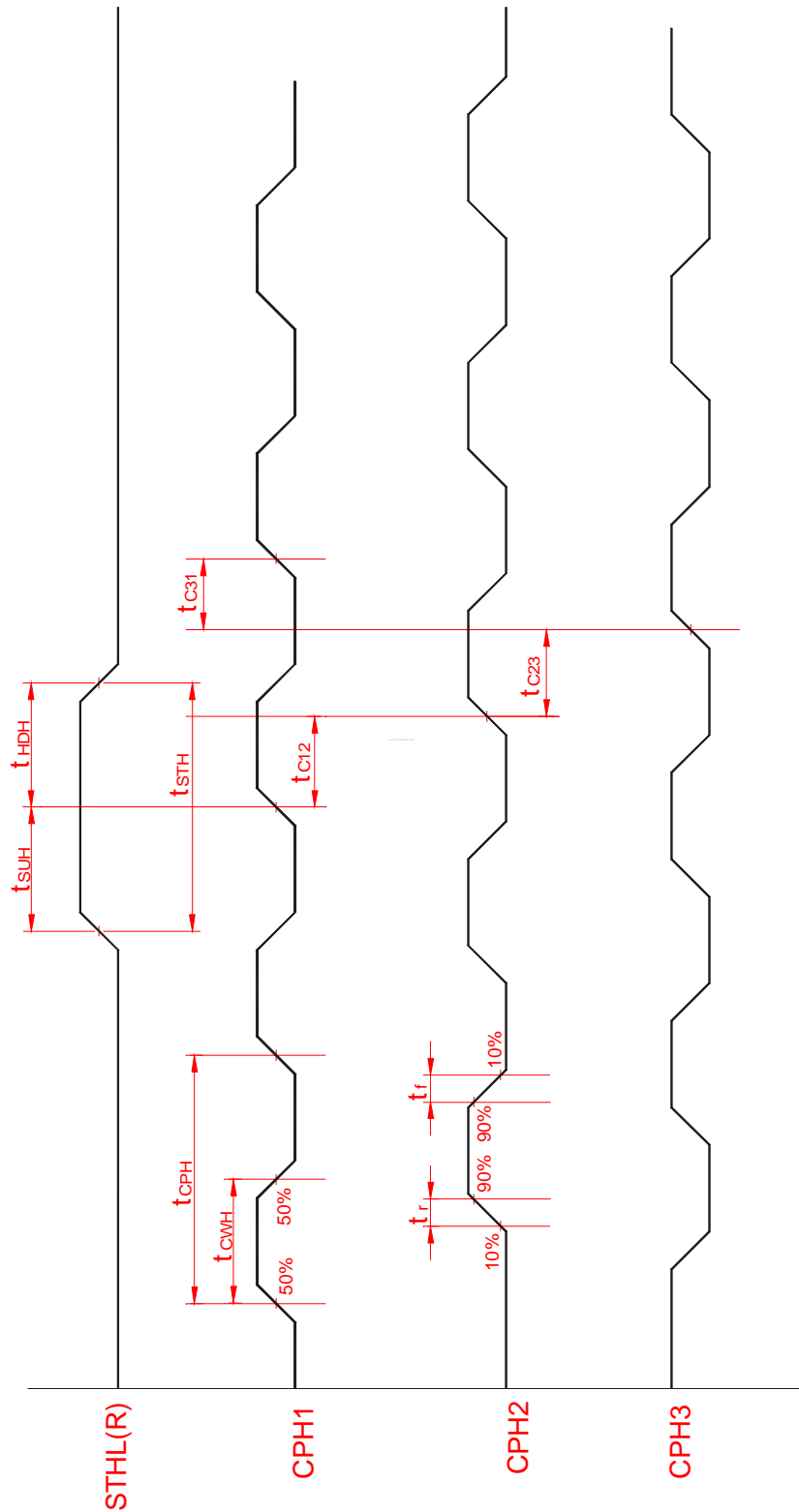
**Fig.1.1 Outline dimension of TFT-LCD module**  
(This outline dimension is available before Oct/20, 2004Y)

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

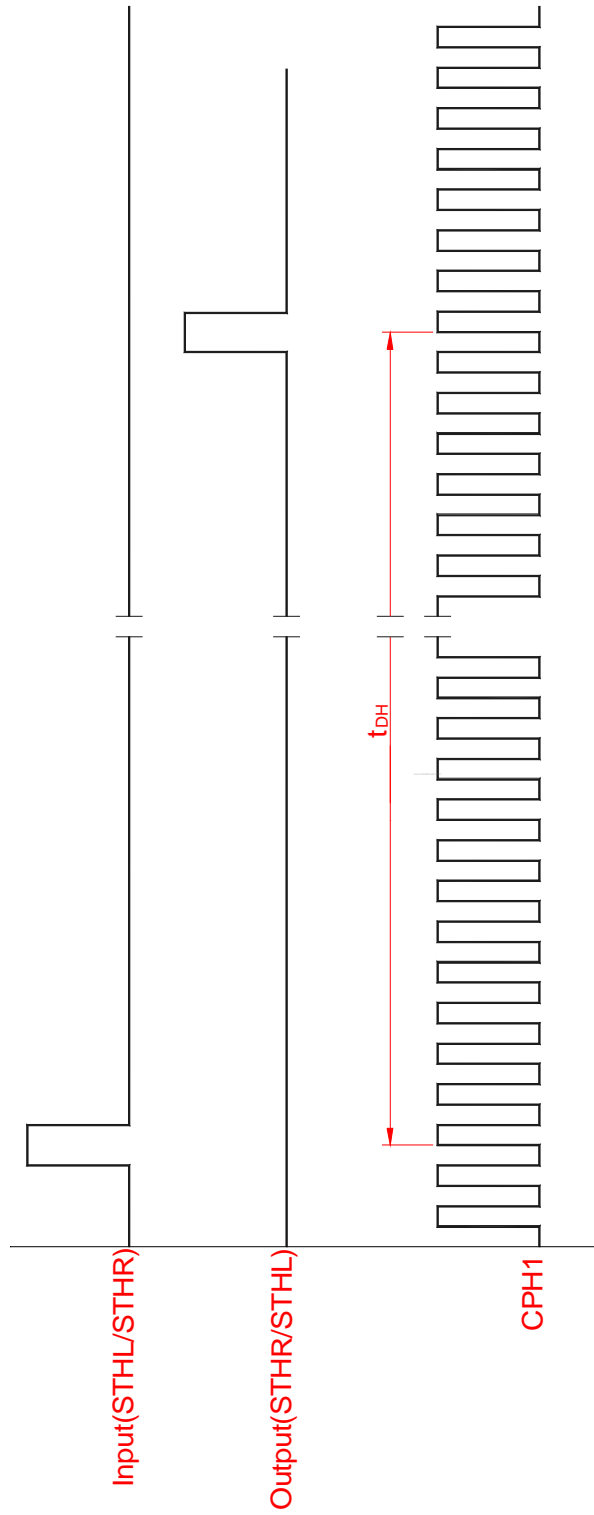


**Fig.1.2 Outline dimension of TFT-LCD module**  
(This outline dimension is available after Oct/20, 2004Y)

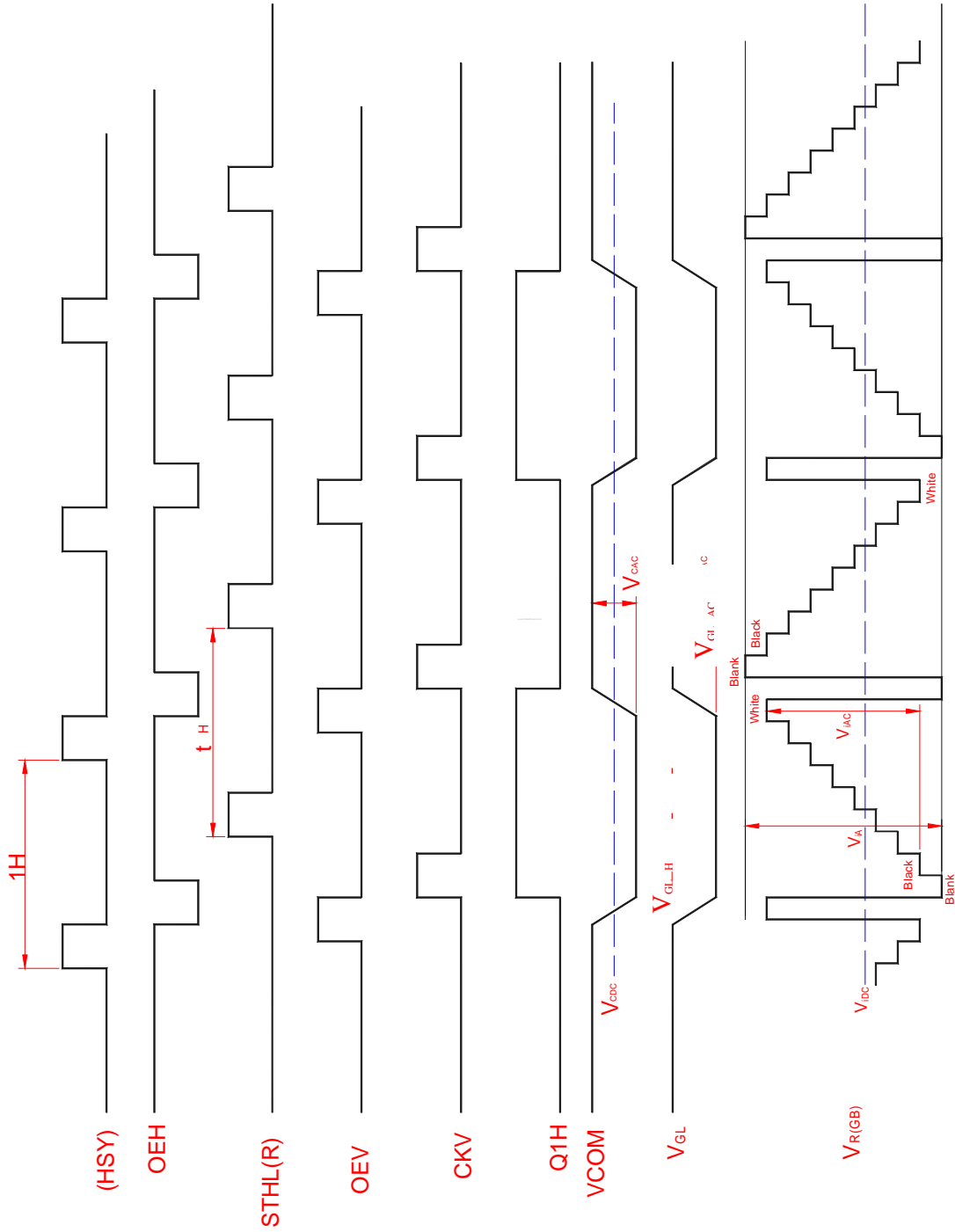




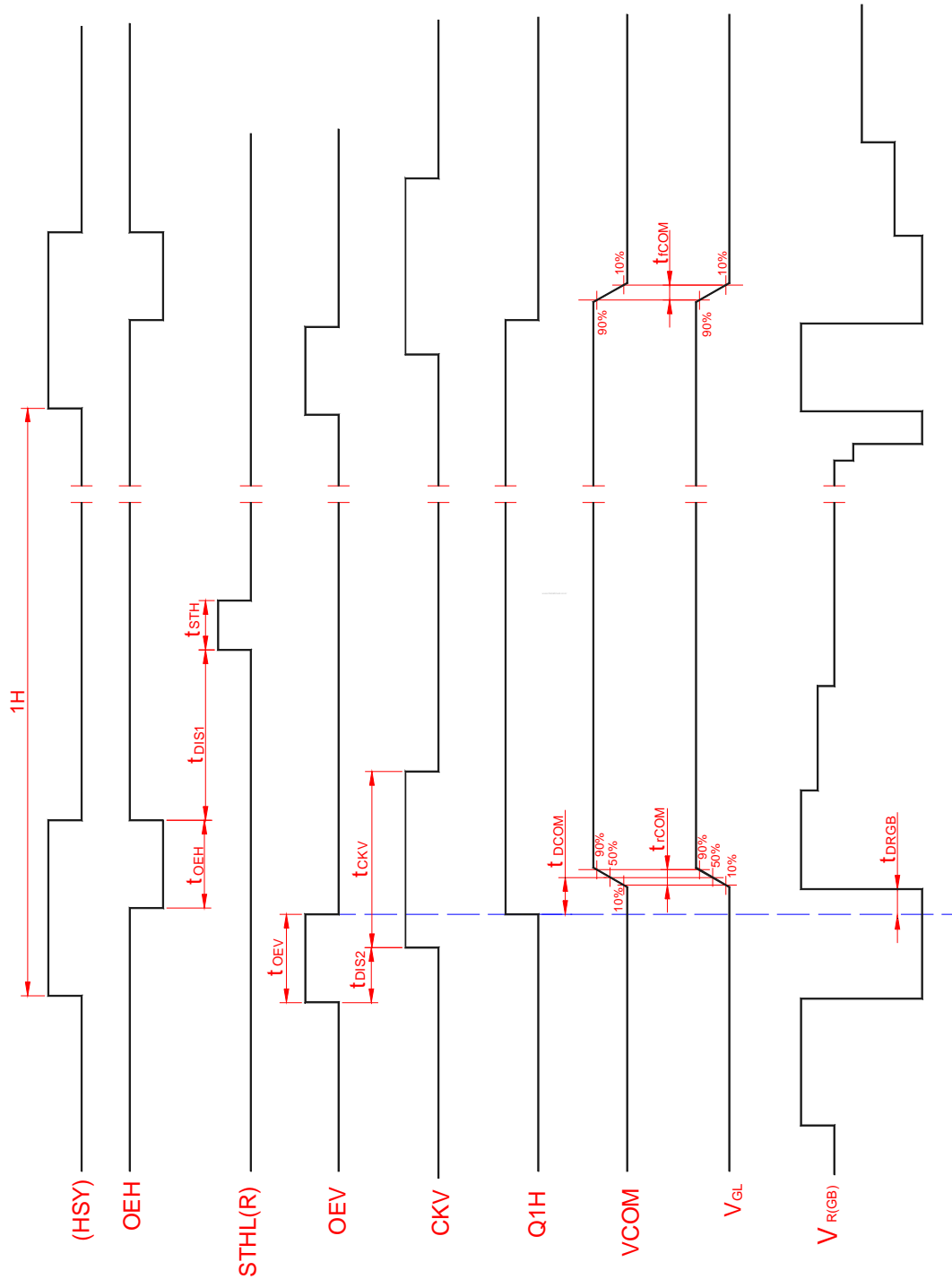
**Fig.2 Sampling clock timing**



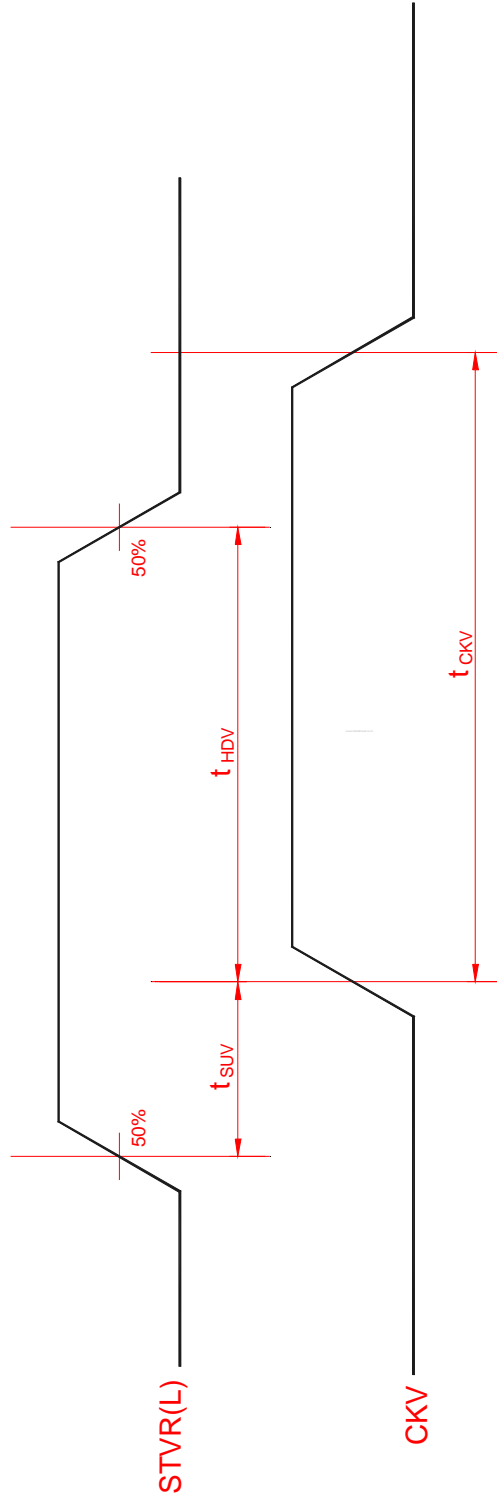
**Fig.3 Horizontal display timing range**



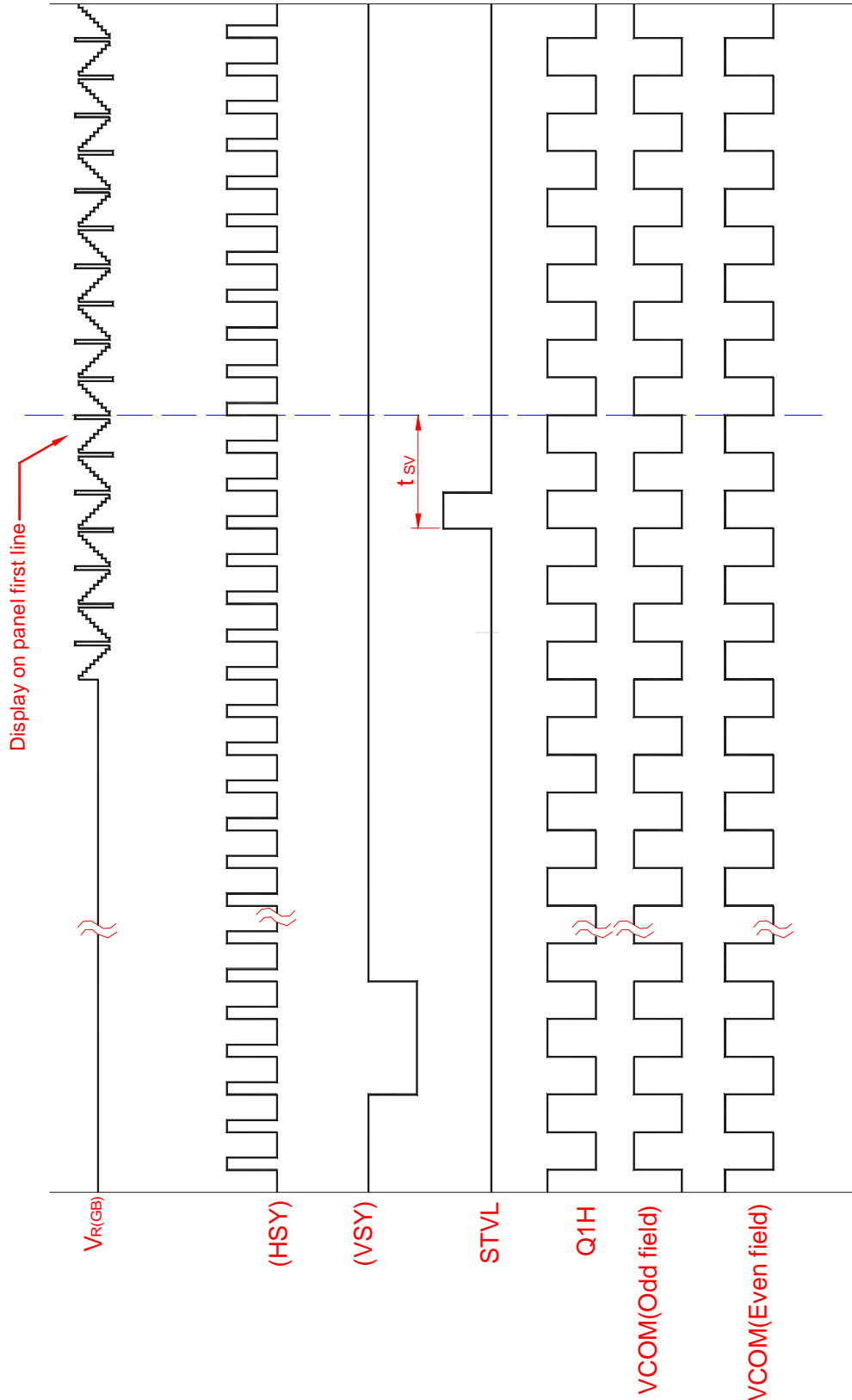
**Fig.4(a) Horizontal timing**



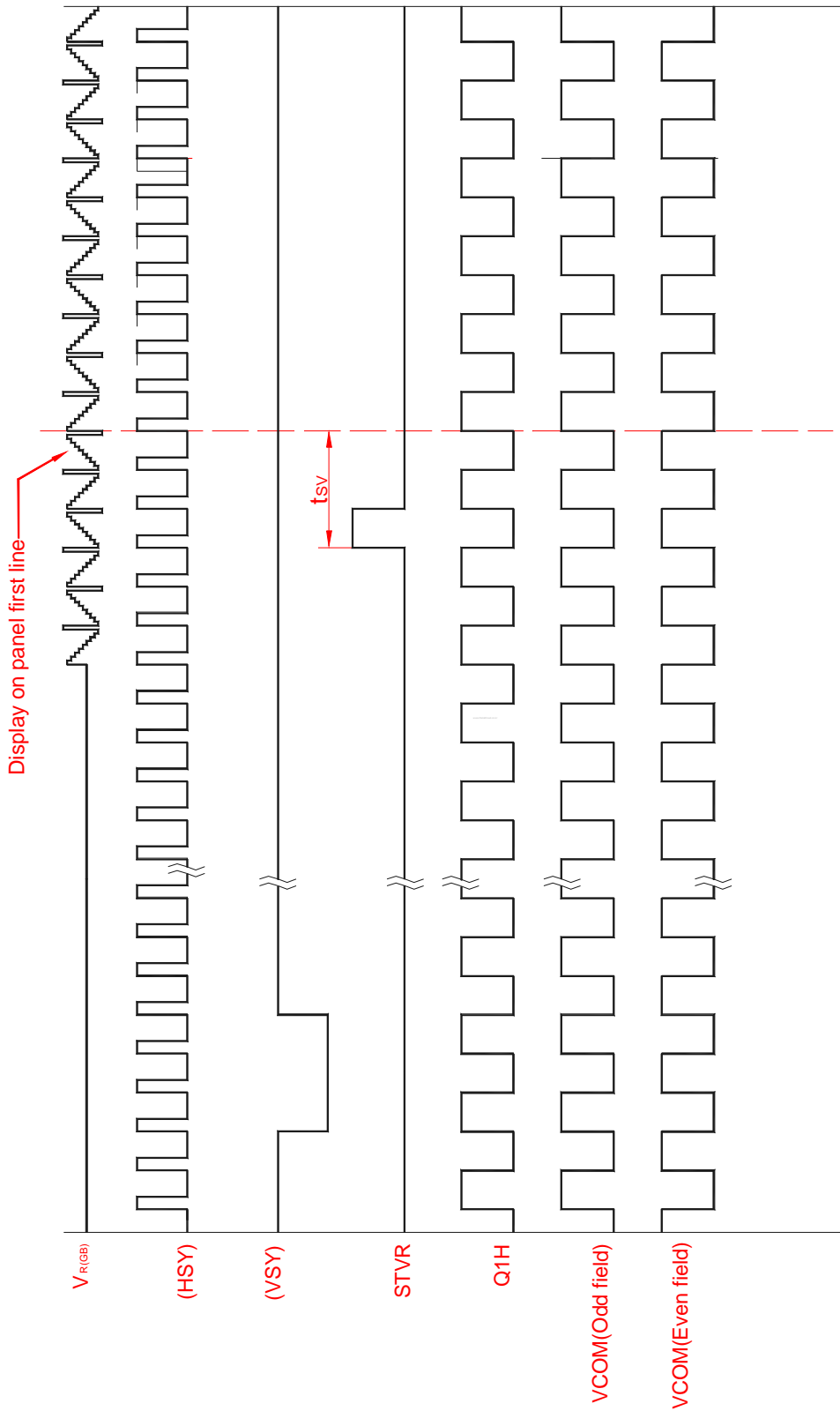
**Fig.4-(b) Detail horizontal timing**



**Fig.5 Vertical shift clock timing**



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



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